THE INDEPENDENT GUIDE TO IBM PERSONAL COMPUTERS

PC

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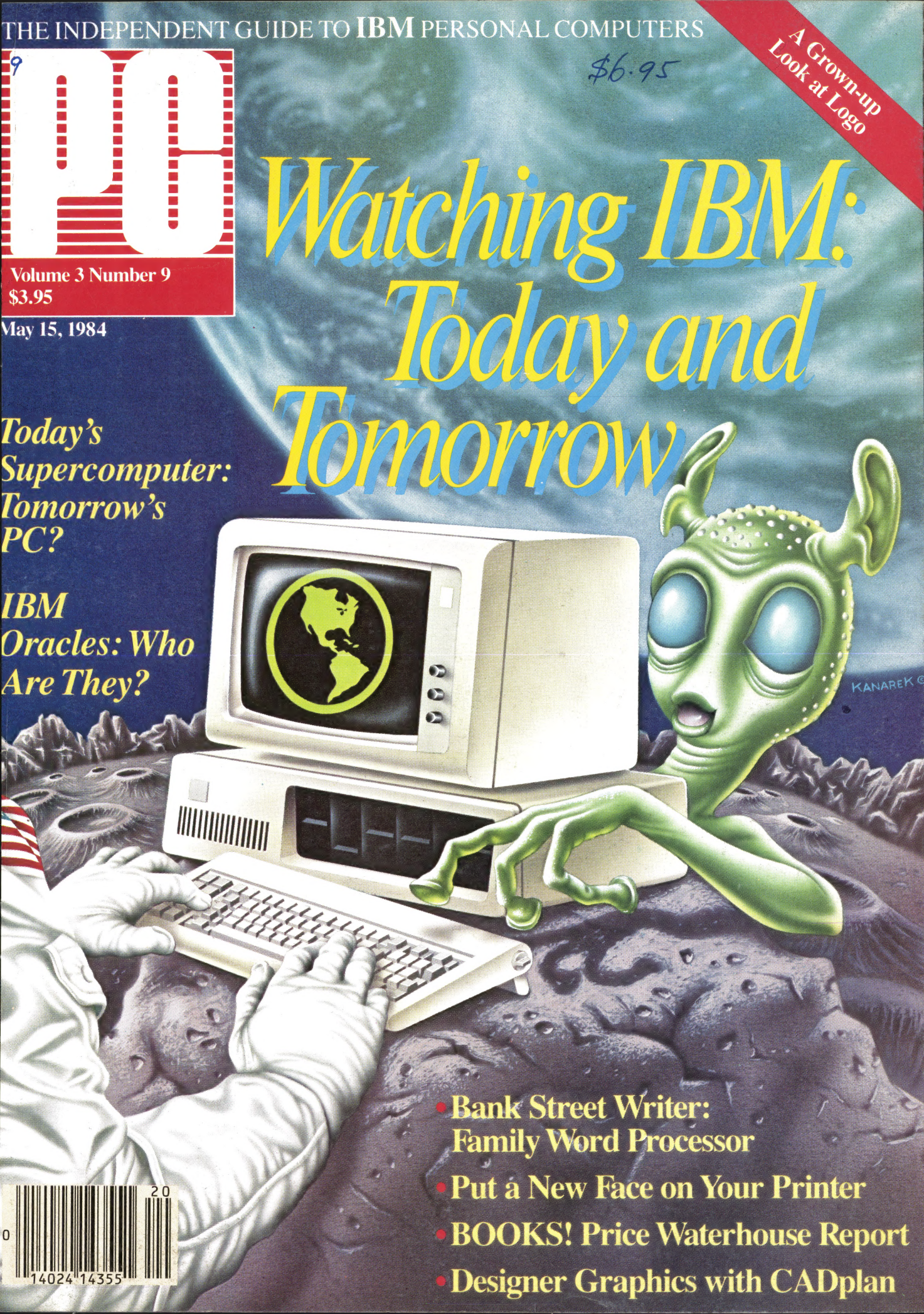
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# Watching IBM: Today and Tomorrow

## Today's Supercomputer: Tomorrow's PC?

## IBM Oracles: Who Are They?

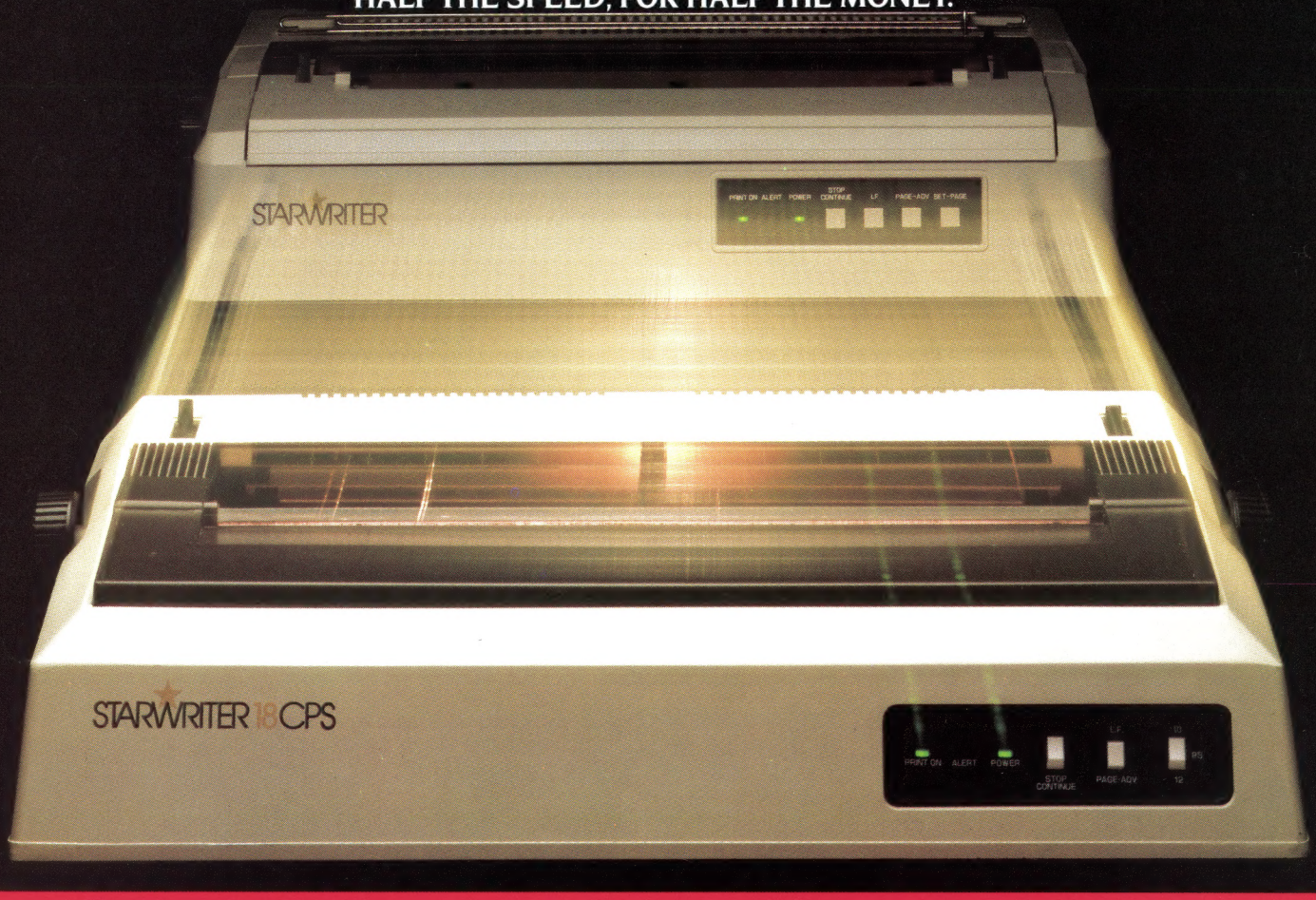



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"We got any dealers in New England with a new Chevy Citation on the lot in metallic silver, blue interior, and stereo with cassette deck?"

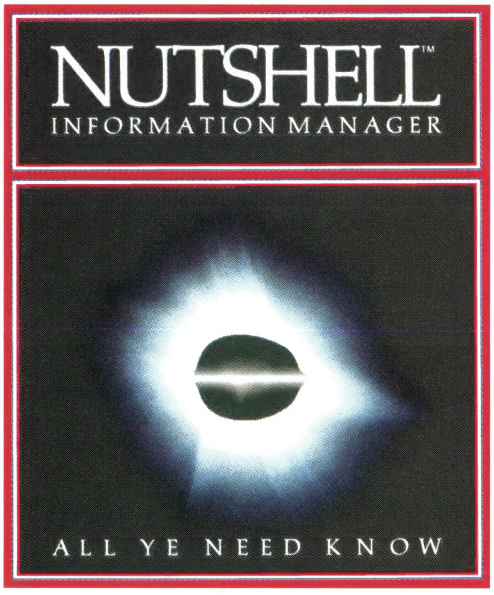
"Of all the furniture we sell, how many pieces in the $600 to $800 range haven't turned over this month?"

"I met this distributor in Chicago who wants to order a million units, and his name is McTavish or McCormack or McMurphy or McCarthy or something, and silly me, I lost the napkin I wrote his name on . . ."

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And so . . .

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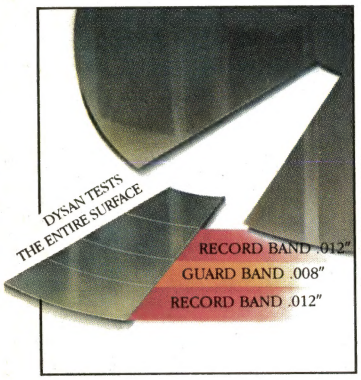
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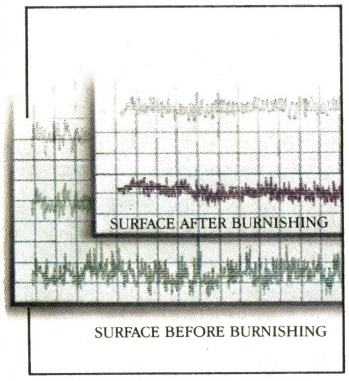
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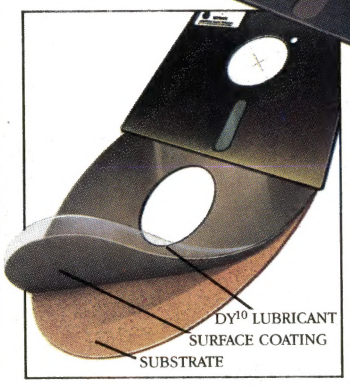
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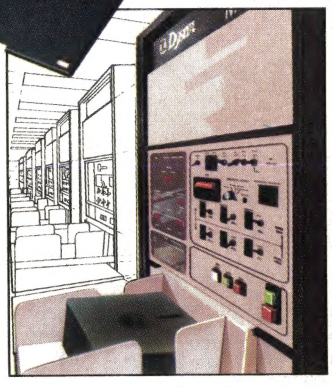
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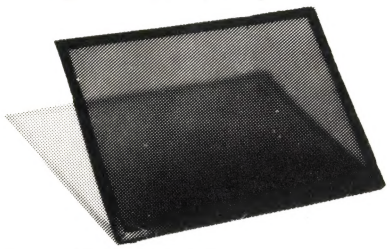
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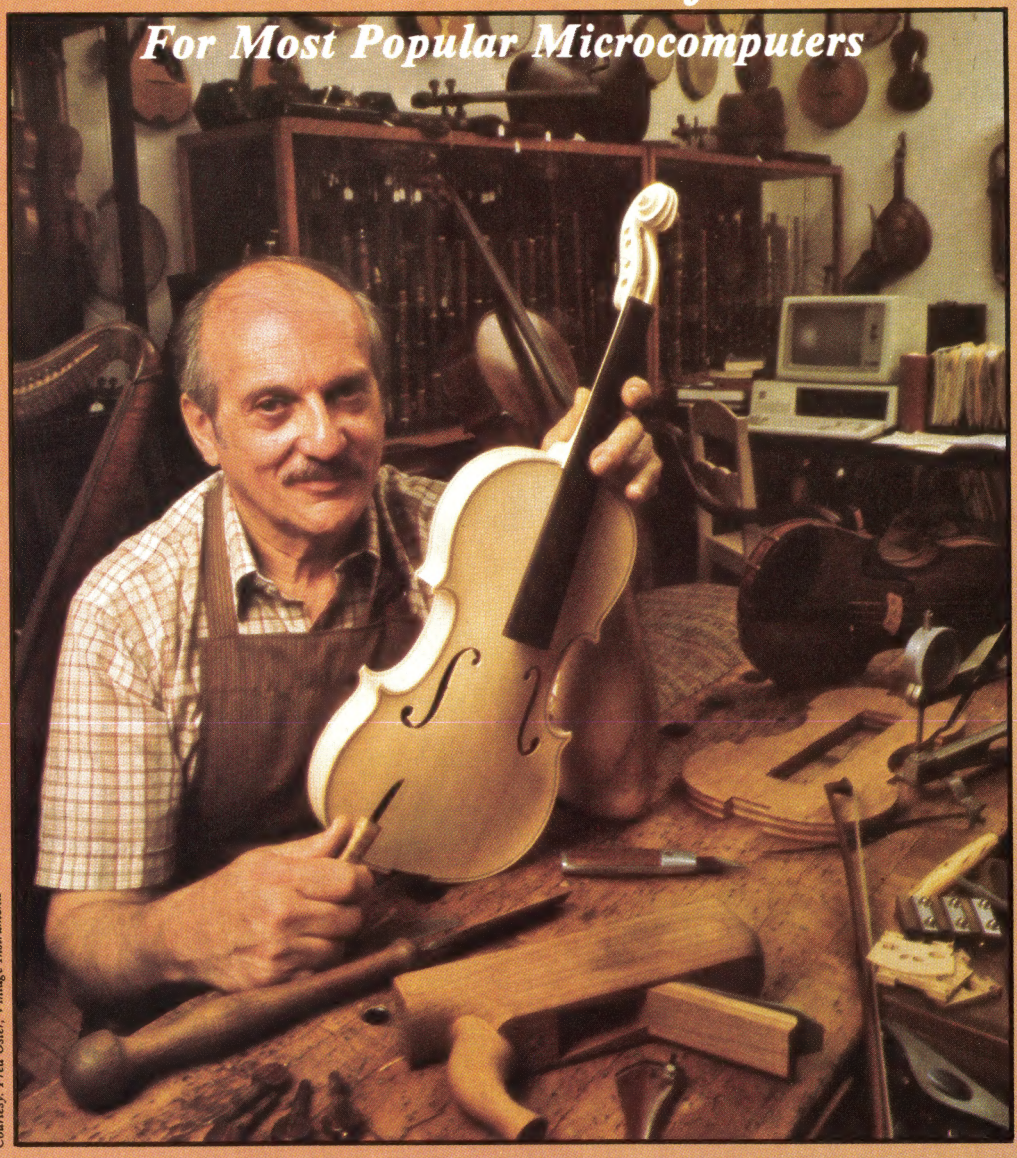
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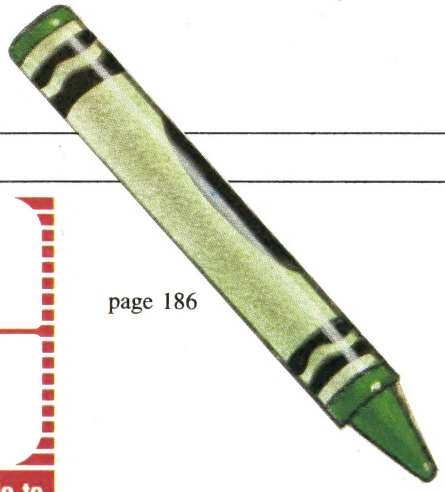
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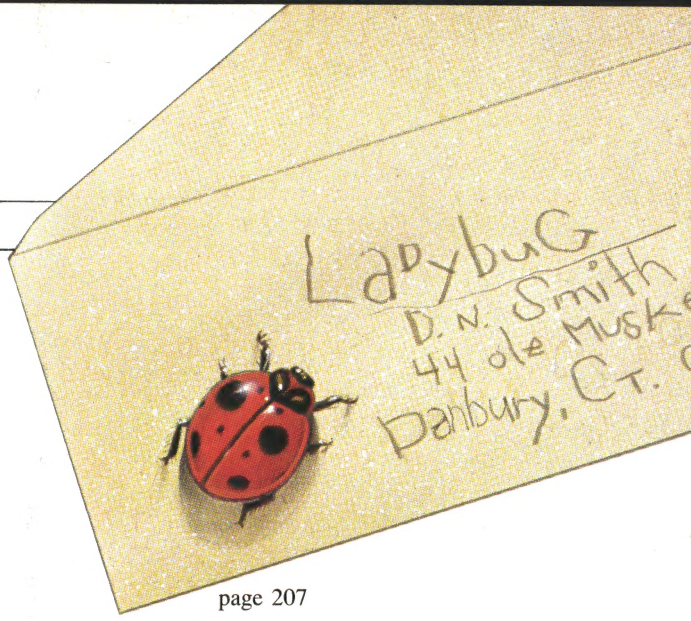
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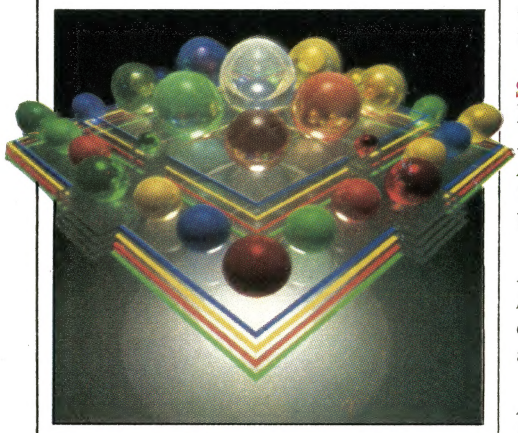

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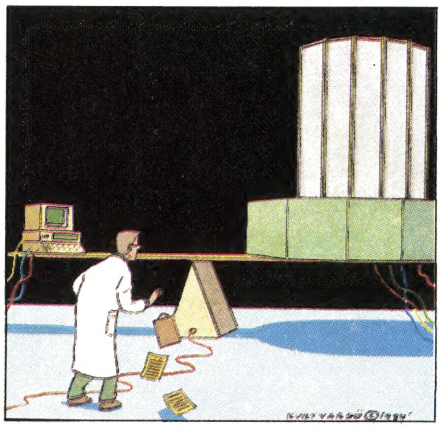
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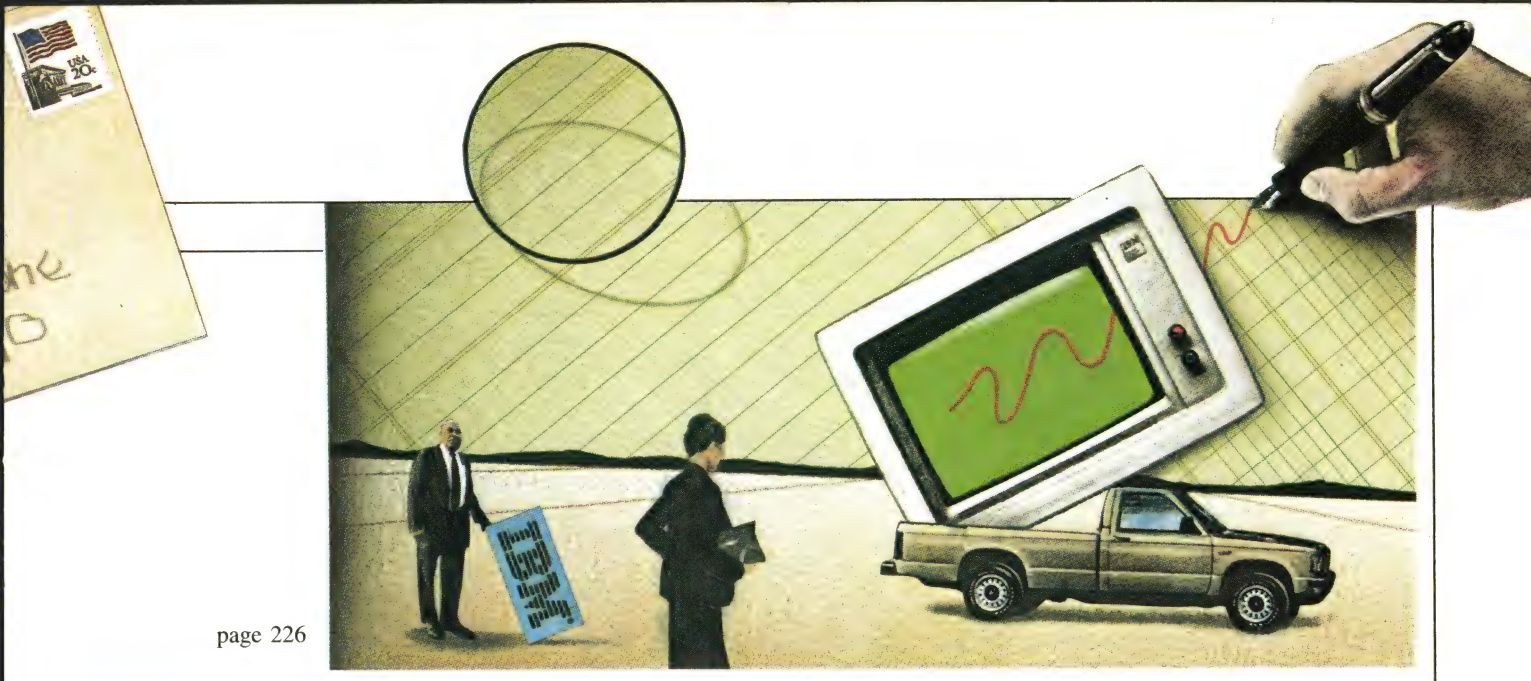
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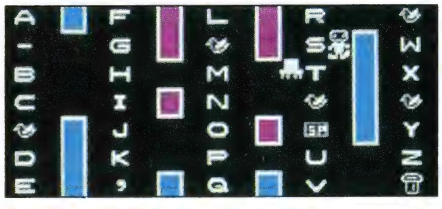
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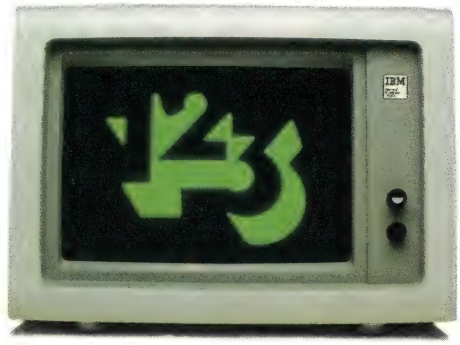
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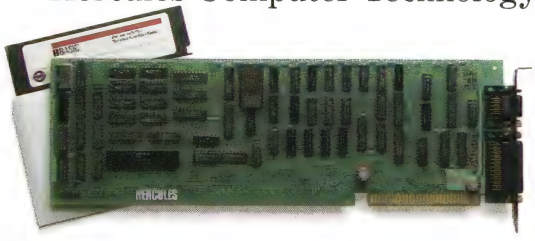
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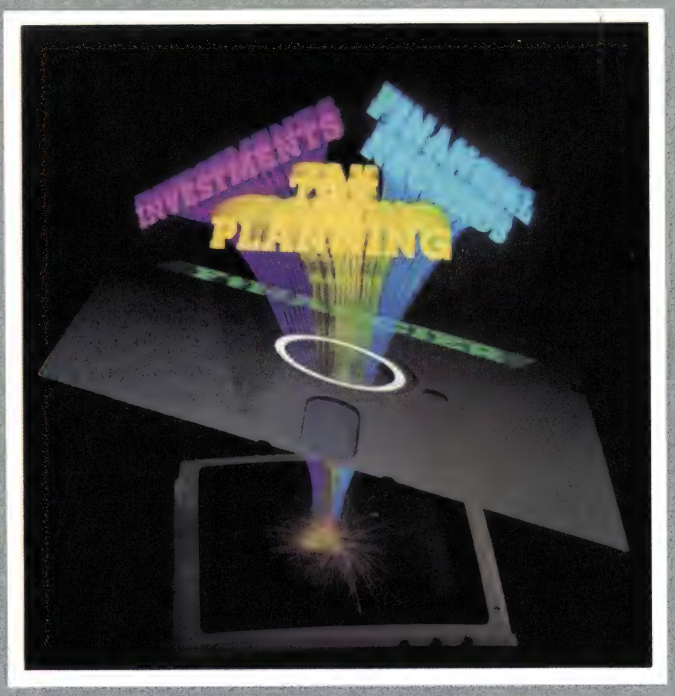
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Reviewer, SOFTALK
June, 1983

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Steven Yoder and
Sherry Knight, CPA
PC Magazine, February, 1983

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Money, June, 1983

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*Lindsy Van Gelder, PC Magazine*

**"My favorite word processor."**
*Will Fastie, Creative Computing*



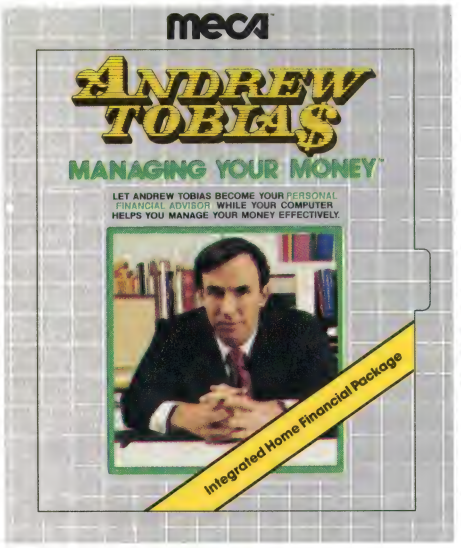

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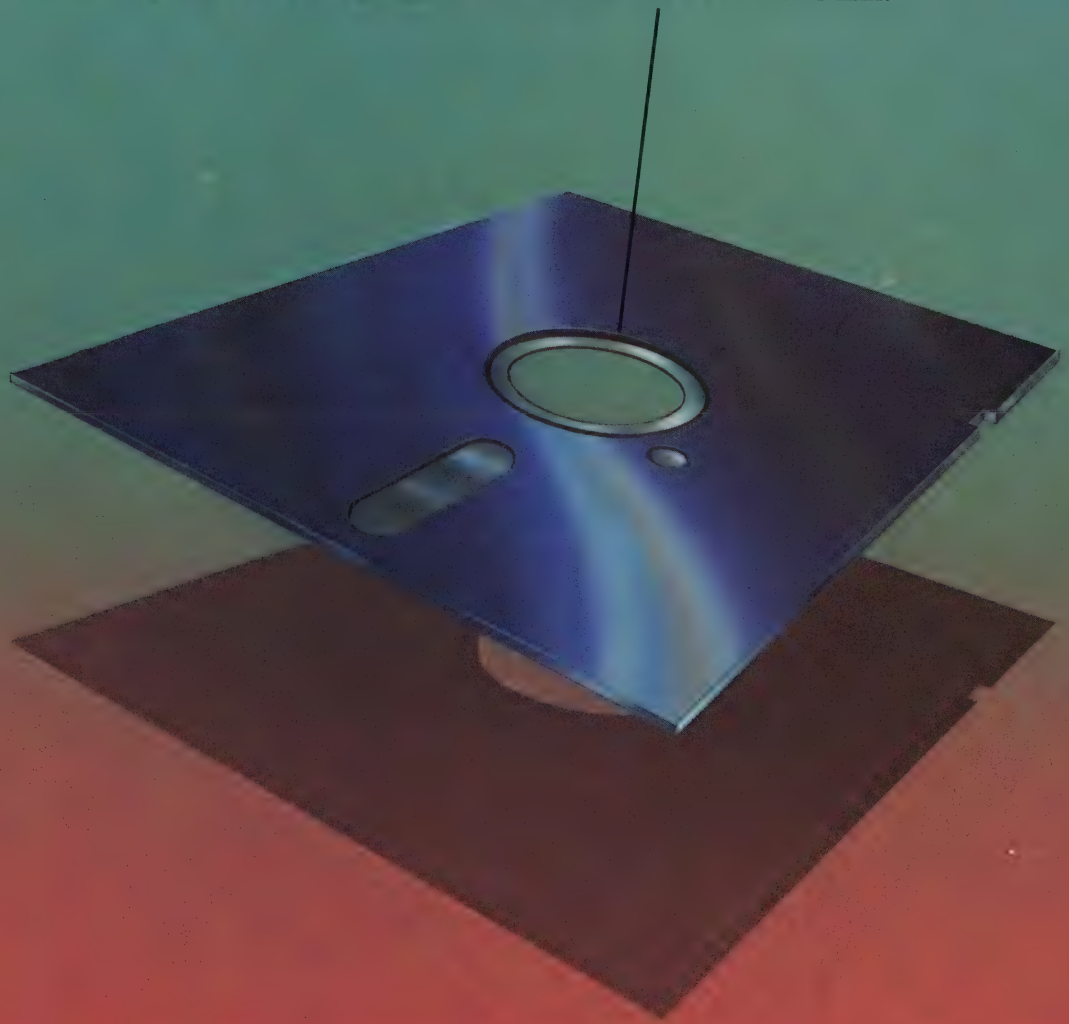
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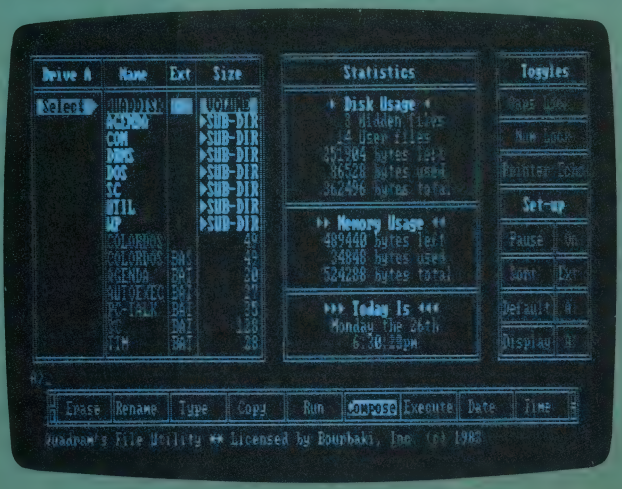
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CIRCLE 327 ON READER SERVICE CARD




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CIRCLE 117 ON READER SERVICE CARD

The Independent Guide to IBM Personal Computers

# What's Inside

## A spy finds his way into PC's Toy Room and lives to tell the story. In this issue we compare the IBM PC with a supercomputer and come up with surprising conclusions.

In these high-tech times, it's hard for an honest, hardworking, computer magazine editor to make a living without running into problems that would make an IBM mainframe shudder.

Just the other day, I was called in on a top-secret assignment by the publisher of that well-known computer magazine, *Marvy Micros*.

"I hear that *PC Magazine* is doing an issue on the Cray," growled my boss, biting down on her cigar. "Go over to their offices and get the story."

I knew the only way to get past the guards at the IBM PC's top paper peripheral was to pretend I was a typical computer magazine editor. So a few hours later, wearing a blue pinstripe suit and thick black glasses, I strolled confidently into *PC* headquarters. I nodded at the receptionist, passed through the glass doors, and found myself in a maze of offices within offices within offices.

"Clever," I thought. "Only a true member of the microcomputer community would be able to negotiate this pathway. It probably follows the pattern of a memory chip, or something equally nefarious."

By following an unsuspecting copy editor, I finally found myself within the inner sanctum of *PC Magazine*. The place seemed deserted. I was puzzled and alarmed at the same time. Were all the staff members at an important press conference at which a new development in microcomputer technology was about to be introduced? Or were the editors of the magazine actually permutations of the latest form of artificial intelligence?



### Into the Toy Shop

My ears caught a faint murmur of conversation from some unseen office. I followed the sound to an ordinary looking door, on which was tacked a sign that read: "Anyone who removes anything from the Toy Shop without first telling someone on the Toy Shop staff will have all his internal organs ripped out!" This was obviously the right place.

The Toy Shop, as anyone who is in on the secrets of *PC Magazine* knows, is the place where the magazine's elite hone their skills on the market's newest hardware and software.

I found the entire editorial staff of *PC* gathered there in conference. What luck! I slipped into the room, ducked behind a pile of manuals, and took out my tape recorder (which was hidden in the December 1983 issue of *PC*).

Executive editor Mike Edelhart (who was wearing a brown suit and matching sneakers) was speaking.

"Crays are the fastest, most powerful computers in the world. We decided to compare PCs with Crays and determine just how powerful the PC is or isn't.

"When you install the Cray, you don't simply put it somewhere—it becomes the room. It looks somewhat like a dentist's office—totally innocuous, with low couches around it. The biggest difference between the PC and the Cray is that you can sit on the Cray."

One of the computers made an unpleasant sound. Edelhart shrugged and continued speaking.

"What you see is only a small part of the machine. The Cray goes through the floor. It requires a mainframe simply to handle the inflow and outflow of information. It generates so much heat that you could probably use it to smelt metal. And, to exist, it requires a specially constructed,

environmentally controlled room. Installing a Cray is good for the local economy; it's like having a new industry come to town.

"In order to put together a comprehensive, informative issue, we tried to find people who had access to both machines. This was difficult, because there aren't that many Crays in the world, and most of them are owned by government agencies. But Paul has done a thorough job of investigating how the Cray and the PC measure up," continued Edelhart.

Special projects editor Paul Somerson had been sitting at one of the Toy Shop's computers, typing away furiously. As Edelhart turned to him, Somerson hit a key, nodded at a printer that had begun chattering away furiously, and left the room. A few seconds later, the printer stopped, and the printout that emerged was passed around the room. As it fluttered from the hand of the last person, I reached for the paper inconspicuously and read the following:

"Comparing the PC to a Cray supercomputer is a little like comparing a Piper Cub to a Saturn V rocket. Both will move a handful of passengers from one location to another. The Saturn V costs a great deal more, takes years to learn how to fly, requires exponentially more ground support, and is powerful and fast enough to beat gravity. But it's not much good for short hops. The piper will take you from New York to Boston far faster than a car or train, and it doesn't cost as much as the entire gross national product of a small country. And, it can be flown by just about anyone once he learns the ropes.

"It's difficult to write objectively about something as slick and powerful as the Cray X-MP, a machine so well engineered that its designers' greatest problem is the speed of light. So while a gee-whiz attitude about all this certainly does exist, my article is an informative (and perhaps entertaining) glance at supercomputers; it should give PC owners some perspective on the powers of the PC."

Edelhart began talking again. "Michael Hannah, at the Department of Energy's Sandia Laboratories in New Mexico, is responsible for training staff there, both to run the Cray and to run the PCs. They use the Cray for scientific modeling and for government contracts. They use the PCs for just about everything else. The staff members found that using the PC was, for some tasks, more valuable than using the Cray.

> The biggest difference between the PC and the Cray is that you can sit on the Cray.

### Common Ancestry

"Richard Basil, a computer historian from California, gives us his opinion of the future of the PC and the Cray. If you think about it, the two computers had a common ancestor. They both began with ENIAC and UNIVAC in the basements of universities at the end of World War II, and then two paths emerged. One side said, let's take this computer and see how small and easy to use we can make it. What resulted was the PC. The other said, this is the world's fastest computer; let's try to make it faster, and faster, and faster. That is how the Cray was born.

"So now we have two distinctly different families that will probably be reunited in the future. Eventually the Cray's going to bump up against the speed of light—unable to become any faster. So, as the PC becomes increasingly powerful, the Cray and the PC are going to move closer and closer together. In the next generation, you may be able to perform tasks on your PC that are now only possible with the Cray."

I moved a little closer to the group. Unfortunately, I had not noticed a stray PC*jr.* that had been perched precariously on the end of a nearby table. It clattered noisily to the floor. I froze.

Michael O'Cone, the sharp-eyed technical assistant and, (as he puts it) "head elf" of PC, was the first to respond to the interruption. Instantly, he bent down, picked up the computer and examined it gravely. "Must have been the disk drive," he announced. The entire assembly nodded, and turned back to Edelhart.

### Mission Partly Accomplished

I had heard enough. I knew that I had to get back to my office to tell my boss what was going on at *PC Magazine*.

I had no time to lose. I crept out of the Toy Room and fled into the hallway. I thought I would be able to find my way out, but I got lost in the maze until I convinced a secretary to give me directions.

Back in my boss's office, I reported on the *PC* meeting and played the tapes. I paused, waiting for the accolades and offers of raises and promotions that would certainly come my way.

To my surprise, my boss stood up, ground her cigar into my tape recorder, and shouted, "Idiot! Why did you leave at that point? I just got word that Winn Rosch, the contributing editor who writes hardware reviews, is a closet Logo enthusiast who has compared Harvard Associates' PC Logo with the office's IBM Logo. Jane and Hal Lamster, who have been around Logo from its beginning, have written an in-depth study of this language."

And, this issue of *PC* includes articles on laser printers, on the companies that devote themselves to predicting what IBM will come up with next, and on microcomputer software that can create chips for other microcomputers!

I was flabbergasted. How could I have missed all that? Hanging my head in shame, I waited to be punished.

"Outside my door is a box full of motherboards," my boss barked. "One of them has a faulty chip. Find it!"

There must be an easier way to make a living. ■

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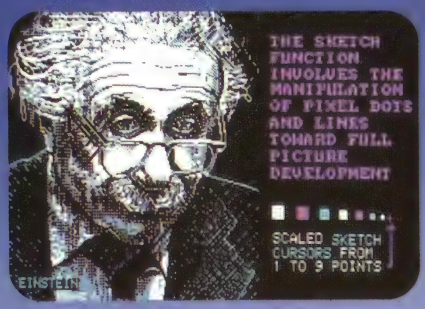
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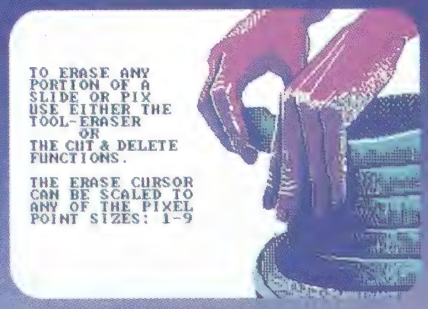
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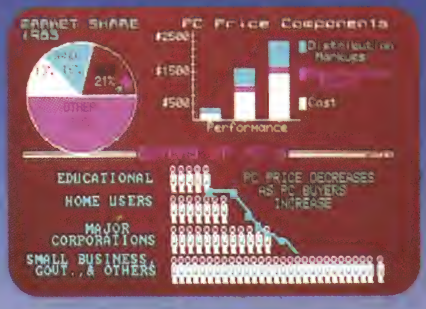
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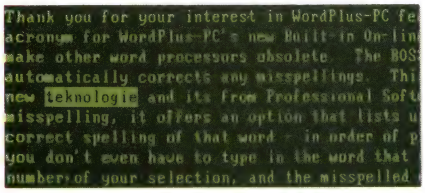
But WordPlus-PC featuring The "BOSS" will do far more than just check and correct your spelling. It's been designed to be exceptionally easy to use and yet contain all the powerful features you expect and more. Like built-in mail merge for personalized form letters, invoice generation and the ability to merge information created by most other popular programs such as 1-2-3™ and dBASE II™. And if you have a question, just press the HELP key to get back on track.

You can also print bar graphs and other charts,** easily move columns, scroll horizontally, execute global search and replace, boilerplate text, and even print proportionally spaced on selected printers. And WordPlus-PC is compatible with virtually all popular letter-quality and dot matrix printers.

*With 90,000+ word standard dictionary and ability for a user to add over 10,000 "custom" words.

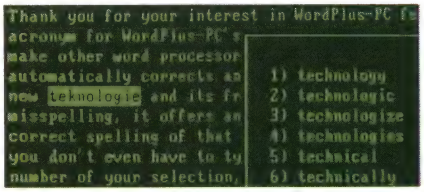
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### IT CHECKS



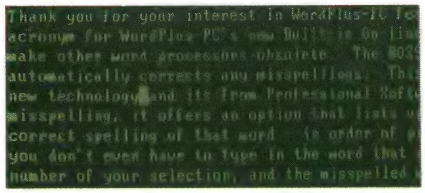

At the touch of a button, virtually anytime during typing or after the creation of a document, The "BOSS" locates and *highlights misspelled words* on your screen. The "BOSS" can even check the spelling of a word directly after it's been typed in.

### IT SUGGESTS




When a word is misspelled, the user can ask The "BOSS" for suggestions as to how to correctly spell the word. With only one keystroke, The "BOSS" will display, in a dynamic on-screen window, up to eight *spelling suggestions in the order of probable phonetic correctness.*

### IT CORRECTS




And The "BOSS" *Auto Correct* feature enables users to "fix" these misspelled words directly in text with a single keystroke. The "BOSS" is a total spelling system that Checks, Suggests, and Corrects your Spelling. All built-in.

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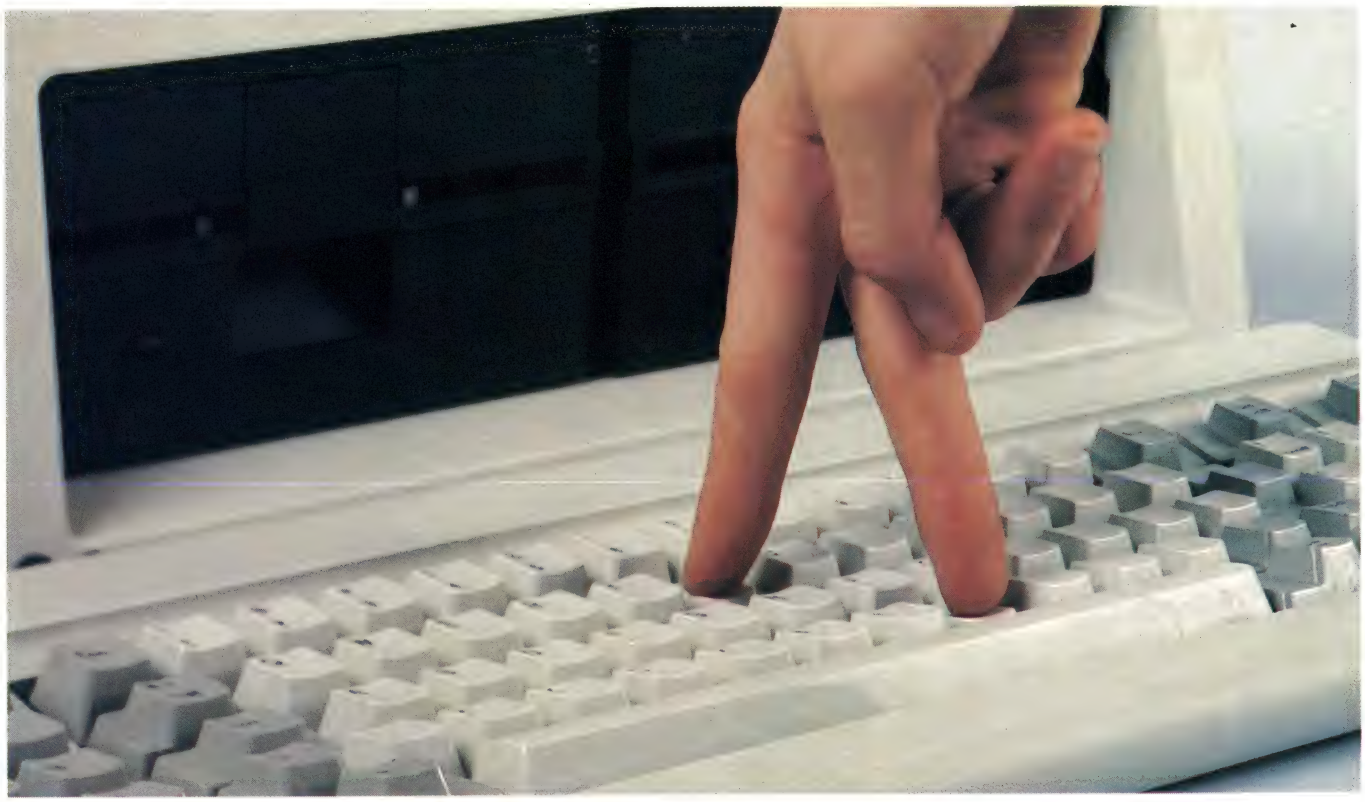



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And while you're at the office, your family will find plenty to do with PC*jr*.

## THE BRIGHT LITTLE FAMILY ADDITION THAT CAN GROW UP FAST

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Children can learn new ways of learning, and make short work of homework. Adults can keep track of household expenses, write letters, file tax data, plug into information networks. And everyone can enjoy challenging new cartridge games.

IBM designed PC*jr* with lots of bright ideas to make computing easier.

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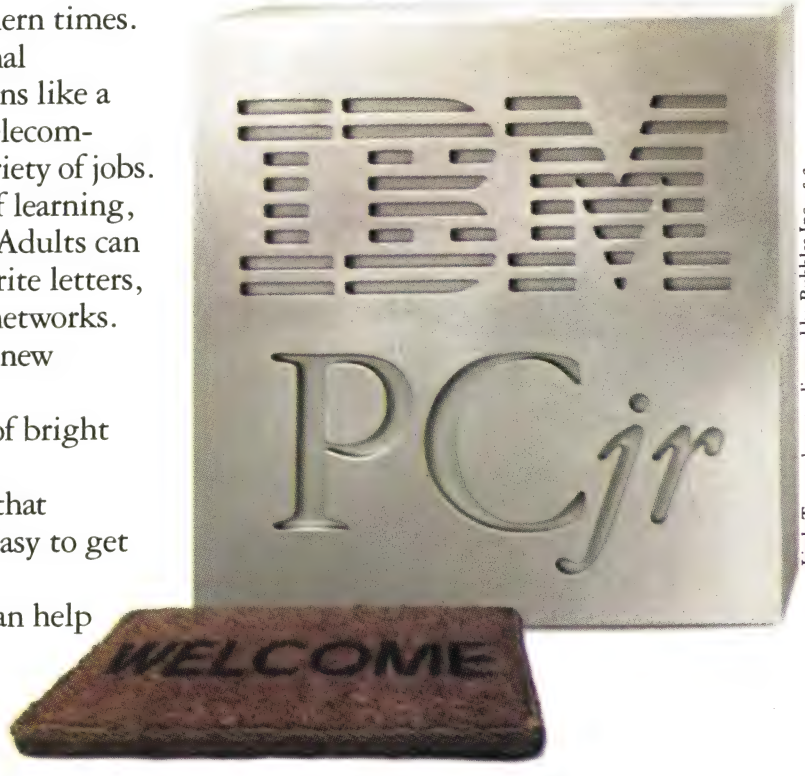


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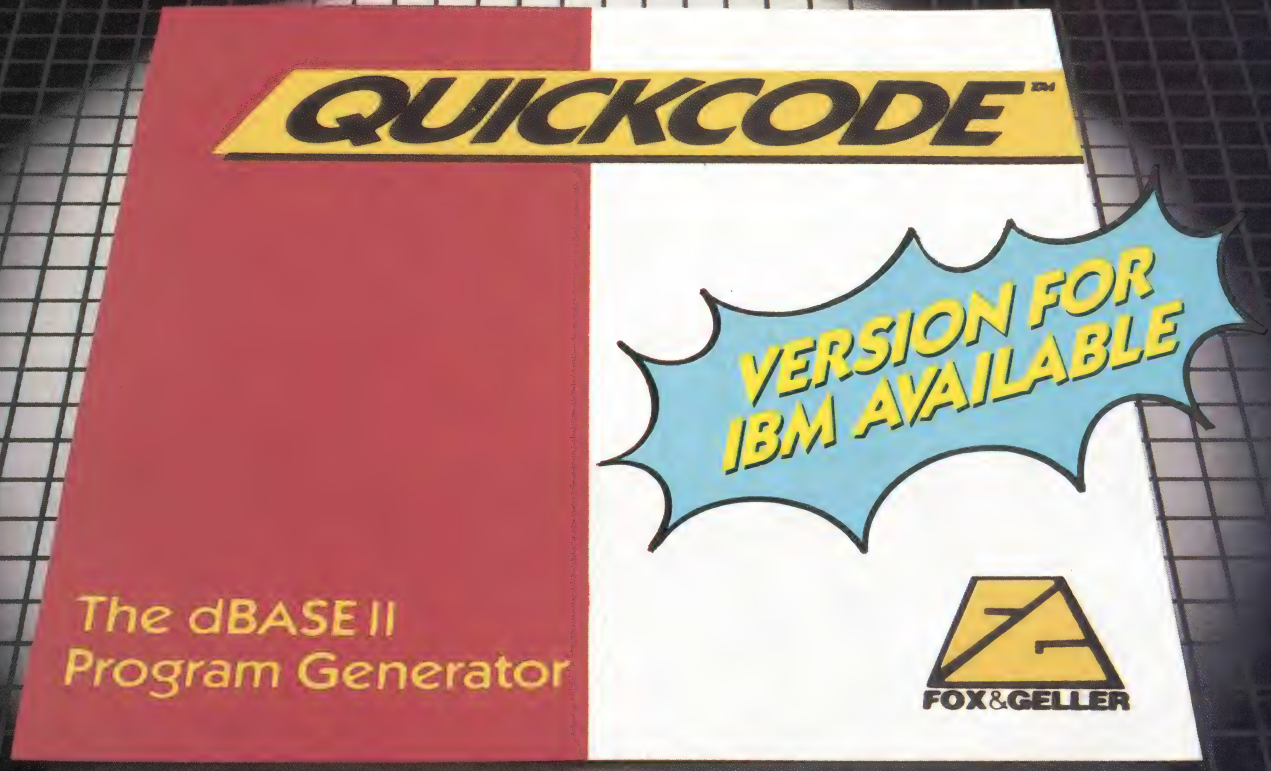
For a demonstration, visit an authorized IBM PC*jr* dealer or an IBM Product Center. And you can find the store nearest you with your little finger. Just dial 1-800-IBM-PCJR. In Alaska and Hawaii, 1-800-447-0890.




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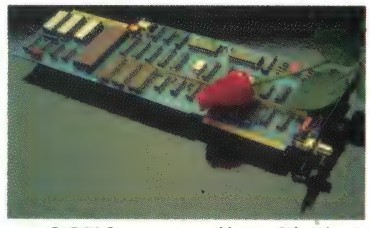
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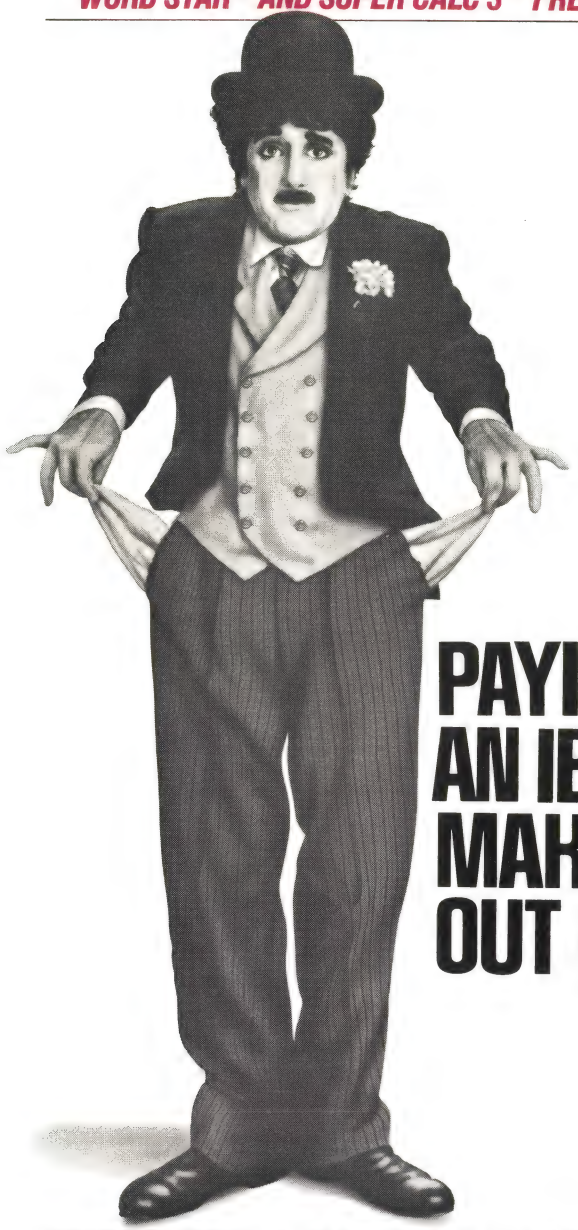
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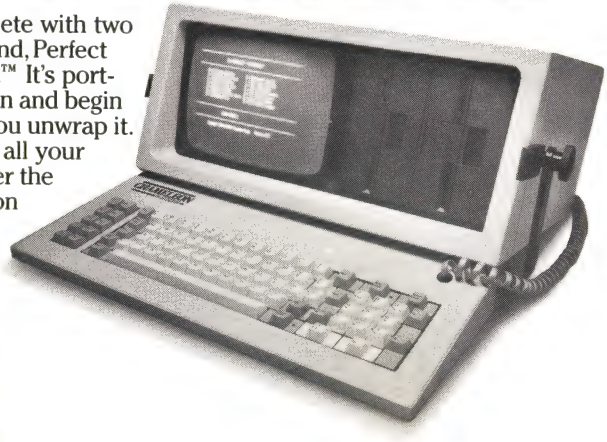
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CIRCLE 370 ON READER SERVICE CARD

Trends and Developments of IBM Personal Computers

# IH News

FROM THE EDITORS OF PC

MAY 15, 1984

# IBM Rapidfires PCs

## Boca Raton speeds PC production and promises Local Area Network that's more than Peanut Cluster to enhance office processing

BY CONNIE WINKLER

BOCA RATON, Fla.—IBM is burping out PCs one every 16 seconds, and by the end of the year they'll be rolling off the assembly line one every 7 seconds. Wow!

This will triple IBM's 1984 PC production over last year, Philip D. Estridge told 180 stock watchers visiting the Boca Raton PC birthplace for a recent New York Security Analysts meeting. Estridge, leader of the PC pack in Boca Raton, is president of the Entry Systems Division (ESD).

IBM has never revealed official PC production figures, nor does the tripling of production statement really help. However, analysts now suspect IBM will produce about 2 million PCs of all varieties this year.

To accomplish all this growth, ESD will spend $500 million in 1984 on plant and facilities. The division plans to add a new production line to the four in Boca Raton and open another PC plant in Wangaretta, Australia, to serve the Near East.

"We continue to see orders for PCs and XTs growing—we don't see the beginning of the end to demand." For the PC*jr*, however, Estridge said supply and demand were "relatively balanced," which many analysts interpreted to mean that PC*jr* is not selling with the gusto of the PC.

### New PCs?

What about new versions of the PC, perhaps one with multi-user capability running the UNIX operating system and based on an Intel 80286 (a chip, incidentally, in short supply).

The IBM speakers acknowl-

*(continued)*

# PCs Key In On Radio Signals

## How receptive is your keyboard? Perhaps more so than you want

BY MARTIN PORTER

The IBM PC keyboard has a serious case of RFI, and it's got it bad.

Radio frequency interference (RFI) is a consumer electronics—as well as military and industrial—phenomenon whereby hair dryers, cordless telephones, even IBM PCs broadcast or receive radio broadcast signals that disrupt normal operations. In many instances this produces an audible noise that seems to be caught inside the system—for example, a police band playing over your home stereo receiver. In the Personal Computer it either crashes the system or causes the keyboard to transmit gobbledygook to the CPU, or noise to nearby electronics, according to reports from PC users.

PC owner Maurice E. White of Papillion, Nebraska, recently found his micro wreaked havoc on a $40 cordless phone he had

*(continued)*

# Running Interference

Dear PC Magazine:

You must be receiving at least some inquiries concerning the PC and radio frequency interference (RFI) from amateur radio stations and roving CBs. If not, you will be. I live in the same house as a 1,000 watt amateur station and was, until recently, suffering spurious character generation and program crashes of the most disasterous kind.

IBM's official line on this, via ComputerLand, was: "Our product is FCC-approved; please take a walk."

Of course, the amateur radio operator's equipment is also FCC-approved. Not only that, but his station consists of the newest ICOM equipment, custom-grounded 3 feet away, with cascading filters, beam antenna—the works.

As per ComputerLand's suggestion, I traded my EPD Lemon from Electronic Protection Devices for the EMI-RFI-proof Peach. No dice. ComputerLand called on IBM Boca for technical advice. IBM suggested a custom ground, beam antenna, tin foil wallpaper for my office, and "alternate operating schedules" for myself and the radio amateur. I found these suggestions less than helpful. With full testing cooperation from the ham (my father, who has been licensed for 40 years), I disconnected the modem, the phone line from the modem, the

*(continued)*

**IBM** *(continued)*

edged that they're working with UNIX, but Estridge downplayed the 80286 possibilities. "It wouldn't make sense to build new products on parts we couldn't get," he said.

IBM's decision to manufacture Intel 8088 microprocessors (the heart of the PC) in-house was not a response to the parts shortage but an attempt to complement the "rest of IBMs business objectives," he said. "The parts shortage is pretty much behind us for the near term."

IBM will enhance the power and functionality of its networking capabilities, certainly beyond the Cluster products (announced with the PC Portable) that connect PCs, PC*jr*s, and XTs, with an XT as the file server.

The local area network would have much more power and function than the Cluster, said Estridge, adding, "Most of the technology needed to do this will be here this year." The Cluster, he said, is "an idea of what is yet to come."

"We are spending a lot of dollars in 'real LANs,' " chimed IBM president John F. Akers.

IBM knows where its customers are headed with PCs because of its own employees. "Our use is a precursor to the use we can expect by our major customers," Allen J. Krowe, IBM senior vice president and chief financial officer, told the 180 Wall Street analysts.

Currently there are about 22,000 PCs installed within IBM, with about 55 percent connected to host computers. By year-end, 75 percent of the 60,000 installed will be connected to large mainframe computers, Krowe predicted.

### PC Growth

Both Akers and Estridge see the action moving toward software. Akers looks at bottom-line results—over the last 5 years on a compounded growth rate, IBMs software revenues have grown 42 percent.

Estridge today counts 5,500 software applications for the PC; for next year he predicts 11,000.

Indeed, the challenge of developing follow-ons for the PC thickens. "You have to plan for the new to fit with the old. The equation becomes terribly complicated," Estridge said.

Balancing what's new with what's gone before also concerns Akers at IBM's Armonk headquarters. "We have to avoid PC myopia," said Akers. ■

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**Radio Signals** *(continued)*

been given for Christmas. "As soon as I turned on my PC I thought the whole world was trying to ring me up."

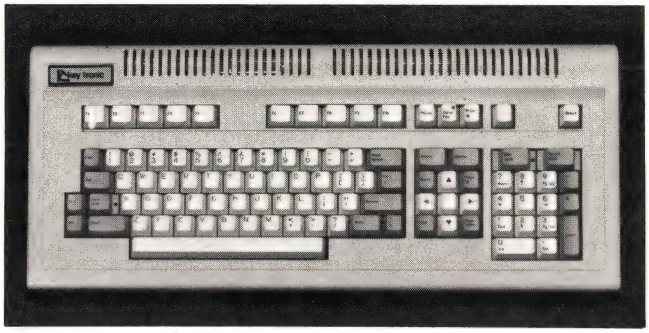
In the case of Travis Charbeneau of Williamsburg, Virginia, the problem was especially severe since he lives in the same house as a 1000-watt amateur ham radio operator—his father. This was no run-of-the-mill ham radio rig, Charbeneau reports; it was custom grounded, used cascading filters, beam antenna, FCC-approved equipment—in short "the works." This system would crash his PC, which, in turn, would take revenge by emitting "spurious" RF that blanked out the radio in the 21–28 megacycle band. Charbeneau disconnected the phone line from his modem, and his RS-232 cable and printer from the processor, but he got no results.

Charbeneau's ultimate solution oddly came at the suggestion of a IBM technical representative in Boca Raton, who asked not to be identified. He recommended a new keyboard—a Key Tronic 5150—which has, so far, done the trick.

Sources at Key Tronic in Spokane, Washington, say the company has received several similar reports that their 5150 is not bothered as much by RFI as the IBM keyboard. One Key Tronic customer, who installs PCs in radio stations, regularly customizes his client's micros with the Key Tronic substitute to alleviate the problem. Key Tronic has a free-lance technician currently investigating for an internal report why the product works while IBM's keyboard doesn't. Key Tronic declined to give more information.

"We still hope to sell keyboards to IBM," explained Key Tronic keyboard marketing manager Joe Dooley.

An IBM spokesman said that reports of such RFI occurrences were "minimal" and stressed that any capacitive keyboard may be affected by heavy fields of radio frequency interference. "That could include radio transmission equipment," he added.



"There's nothing wrong with our keyboard," said John Pope, information manager for the Entry Systems Division. Pope urged users having problems to go to their dealers and that the dealers, in turn, forward the complaints to the dealer response center in Boca Raton.

"We do have a commitment to service. We are concerned about our customers. If they have a problem we'd like to know about it," he added.

Pope said he knew of no instances where the PC or keyboard caused problems with the cordless phones.

The RFI problem is complex—and delicate—because of product certification by the FCC (Federal Communications Commission). FCC rules control the amount of radio waves that a computer can emit. There are two standards for commercial and home use. The home standard is more stringent than the commercial standard, because homes typically contain more devices sensitive to radio waves, such as radios, TVs, and stereos. The PC, like most personal computers, is certified to meet the home standard.

*PC Magazine* has learned that both keyboards use interior conductive paint coating specifically to prevent RFI problems. However, one characteristic that might explain the difference is the distance between the Key Tronic componentry and the keyboard outer metal shell. Reportedly, IBM's microprocessors are closer to the exterior than the Key Tronic replacement product.

Yet another PC and ham radio user, Fred Cady of Bozeman, Montana, attempted to solve his RFI problem by insulating his IBM PC keyboard with metal foil. It didn't work. Cady, president of Micro Electronic Systems, a producer of PC software for ham radio users, noticed: "The ham radio gets into the PC and the keyboard goes crazy somewhere in the 7-Mhz band."

RFI is a two-way street. A computer can generate it or be the victim of it. The high-speed electrical signals inside the computer can radiate out from wires and printed circuit traces in the machine in the form of radio waves. If uncontrolled, these waves can cause everything from a buzz in an AM radio to "snow" on a TV screen. Conversely, when radio waves get into the machine, they induce small electrical signals onto the wires. When the radio waves get strong enough, the signals can confuse the computer and cause it to crash.

"Most computers are not designed to work in a strong RF field," explained American Radio Relay League (ARRL) technical information specialist Bob Schetgen in Newington, Connecticut. "Most of the RFI that a computer generates comes from the bus lines or from the horizontal oscillator in the TV monitor. Much of this is solved by separating the computer and the radio by at least 10 feet, or by shielding the micro in foil."

Is the PC a particularly serious contributor to overall RFI pollution? Schetgen's reply: "You probably get more interference from a hair dryer." ■

# IBM-Merrill Lynch Venture Puts Brokers on 3270 PC

## New company will use satellites for near-instant transmission of stock market data needed to "tickle" brokers to buy or sell

BY KAREN COOK

NEW YORK—IBM and Merrill Lynch, the nation's largest retail brokerage house, have formed a joint venture to bring up-to-the-second financial information to Merrill Lynch's account executives, with much of the data going via satellite. The system combines IBM-supplied 3270 PCs with state-of-the-art telecommunications and software from Merrill Lynch and Monchik-Weber.

Although the new system has been in development for two years, the two companies have not yet named the new company or any of its executives. It will not be installed in Merrill Lynch offices until mid-1985, but it may eventually be marketed to other companies.

"We want to turn the money manager of today into the information manager of the future," said Robert P. Rittereiser, executive vice president for strategic development at Merrill Lynch. The company is subcontracting its software from Monchik-Weber, a New York-based financial systems developer.

Rather than relying on slow modem transmissions to the 3270 workstations, Merrill Lynch plans to transmit the bulk of its market data via satellite. The 3270 PC will receive signals in much the same way that an ordinary TV receives broadcasts. Two-foot satellite dishes installed on top of buildings will receive encoded transmissions, then relay information via coaxial cable to the 3270 PCs at each location. The 3270 PCs will be specially equipped to receive, decode, and display data almost instantly.

At the announcement here, large demonstration screens blinked continuously with updates from the New York Stock Exchange ticker and the Dow Jones News/Retrieval service. The 3270 PC can receive and process information from up to four sources simultaneously.

The new system provides account executives with three important services, Rittereiser said.

- Decision support. In addition to running the stock ticker in one of its seven windows, the 3270 PC allows users to create a special portfolio of up to 300 stocks that are constantly and automatically updated. Brokers under orders to sell if company A's stock goes below two can also program the computer to monitor A's stock price. If A falls below $2, the PC will flash "LIMIT" in a "tickler" window.

"Decision support is active and intelligent," Rittereiser said. "It taps the account executive on the shoulder and says 'hey, take a look at page three.'"

- Office automation. Using the 3270 PC's PC-DOS windows, executives can run standard PC packages, including spreadsheets and word processors. "This aspect is not exotic. It's not Buck Rogers. But it is a good step beyond what the AE is used to," commented Rittereiser.
- Interfaces. The 3270 PCs are designed as part of a network that will link Merrill Lynch headquarters to regional and branch offices. Users can send electronic mail from office to office, or even to clients. The 3270 PC, Rittereiser explained, can "alert an account executive to price changes, trading patterns, revised research opinions and news that may affect a stock's price and therefore prompt an investor to take action. A push of the button could then give the account executive a list of all customers affected. Finally, upon instruction, the computer will begin telephoning customers or contact them via electronic mail."

In recent months, Dun & Bradstreet and E.F. Hutton have also introduced software or software and hardware combinations that give computers access to stock reports and other financial data. But these are designed primarily for individuals (using standard communications devices) rather than financial industry professionals.

Said Rittereiser, "Account executives have been engulfed by the information explosion. Where once they handled only two types of accounts—stocks and bonds—they now offer over 100 types, including IRAs and money market accounts." Merrill Lynch wants to be sure its account executives can continue to be "complete financial advisers" to their clients, Rittereiser said. ■

**Interference** *(continued)*

RS-232 cable, the printer, the printer cable—in brief, all channels into the system unit. No improvement. In despair, we abandoned ComputerLand and called IBM Customer Relations in Boca Raton ourselves.

Interestingly, it was Art at IBM who first suggested trying an alternate keyboard, interesting, because when I did in fact acquire a Key Tronic 5150 keyboard and the problem utterly vanished, he denied ever having made the suggestion—much less having implied that IBM would support a trade-back with ComputerLand.

Subsequent conversations with Art and another IBM employee have led nowhere. Their attitude is: If you want to purchase another keyboard, fine. Our product is FCC-approved.

Police stations, fire stations, schools, broadcasting facilities, and anyone who lives near a street is subject to RFI that will crash a PC if it is not equipped with a Key Tronic keyboard. Yet IBM sticks its head in the sand. My local ComputerLand dealer says he was told by Boca that fessing up to this problem would be tantamount to endorsing a competitor's product. Imagine the consequences of *not* fessing up!

The technical engineer for Key Tronic in Spokane told me he'd had at least half a dozen similar complaints, all solved by a Key Tronic 5150. He had me write Key Tronic management about the situation so they could begin to include in their advertising the fact that the 5150 is RFI-proof.

If you're like me, I know you'll find IBM's stance absolutely incredible. So will your readership. Prospective buyers should be forewarned that should a radio frequency environment arise near their PC, they are out of business thanks to the keyboard. Given the noncooperative attitude of IBM, those currently experiencing the problem (which is extremely difficult to trace, especially without the active and continuous cooperation of the offending radio station) should be told what is happening.

They should also be told that FCC-approved amateur radio stations are in no way legally liable; they are not only FCC-approved but specifically licensed to operate at up to 1,000 watts. Incidentally, the PC keyboard itself emits spurious RF that totally blanks out the 21–28 megacycle band of amateur radio—an infraction for which the PC user is responsible!

Sincerely,
Travis Charbeneau
Williamsburg, Virginia

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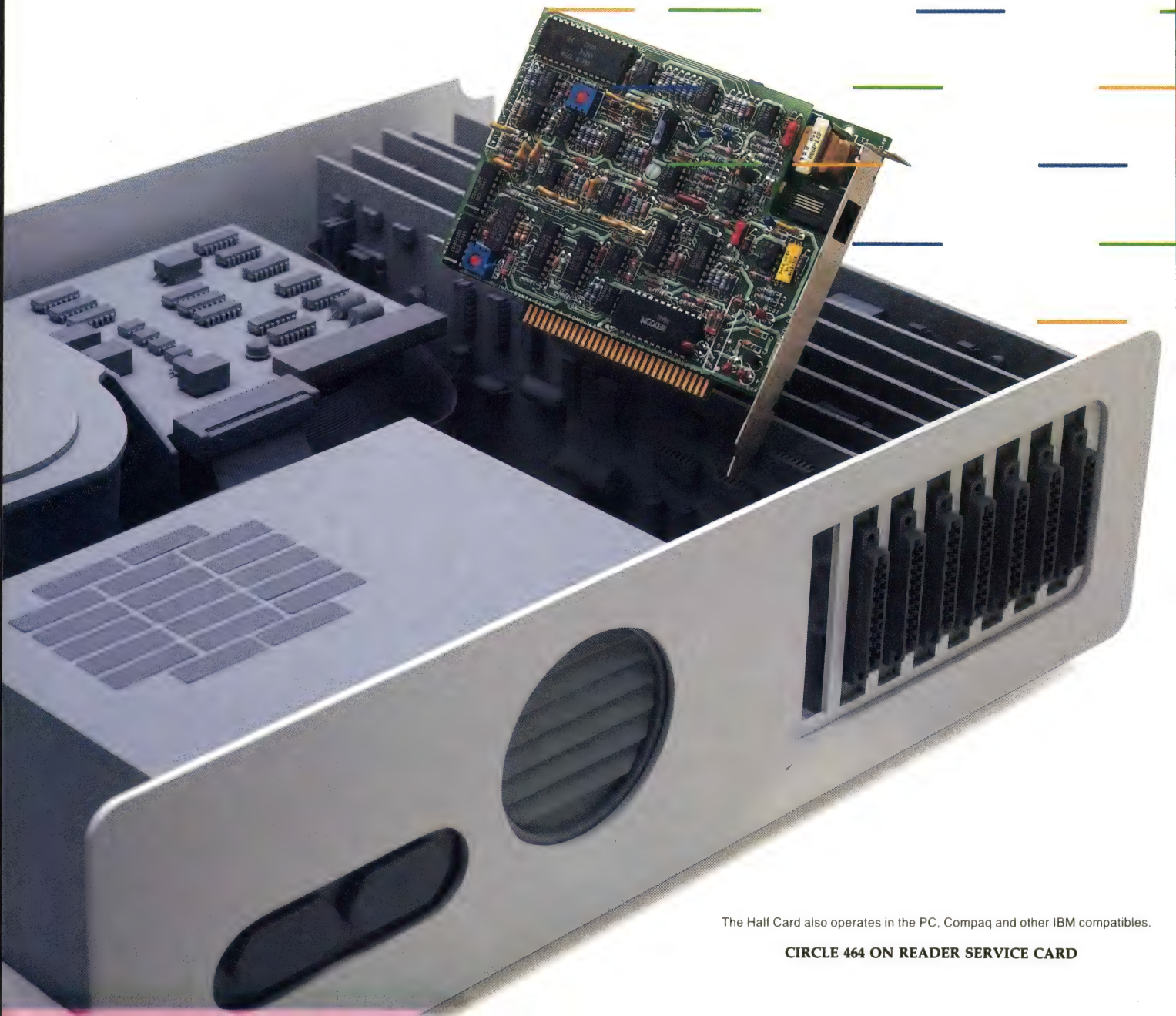
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**CIRCLE 464 ON READER SERVICE CARD**

# Others Dip Into Intel Chips

The 8088 is licensed again, but 80186 and 80286 production is no match for engine control chips at microprocessor factory

BY KAREN COOK

NEW YORK—Intel is letting its chips fall—very carefully. The Santa Clara, California-based company recently announced licensing agreements that, for the first time, allow computer makers to second-source the Intel 8088 microprocessor, the soul of the PC.

In addition to Commodore (see "Commodore adds Hyperion Chips," *PC*, Volume 3–Number 8, page 52), 8088 manufacturers will include IBM and Sanyo Electric Co. of Japan. The new agreement will make it possible for IBM to triple PC production in 1984 (see "IBM Rapidfires PCs," page 33).

In addition to the 8088, IBM obtained licenses for "similar type chips," according to Intel spokesperson Stewart Sando. Neither Intel nor IBM will comment on what those chips might be, but expert speculation has ranged from the 80286 microprocessor expected to drive the anticipated IBM "Popcorn" multitasking PC, to a rather mundane series of support chips that form part of the 8088 system.

Sanyo's licensing agreement will ensure that it will have adequate supplies to make a big drive into the PC-compatible marketplace. In Japan, the chips were reportedly so scarce that one manufacturer attempted to bribe Intel to increase its allocation.

Intel's decision to loosen its grip on the chip that made it famous comes partly in response to complaints that there simply were not enough 8088 chips available to meet the demand.

In addition, "Intel would like to free up production for the more advanced chips—the 80186 and 80286, for example. There are better margins and more profits on those products," says Ken Sonenclar, program director at Stamford, Connecticut's Gartner Group. "Supplies of the 8088 are tight, but they pale in comparison with the shortage of 80186s," Sonenclar adds.

The 80186, now used in the Mindset PC, the Tandy TRS-80 Model 2000, and other computers, is faster and more fully integrated, but still compatible with the 8088.

Why is the 8088, in production for 4 years, still in such short supply? The answer seems to be that there's a lot of competition on the assembly line.

According to Sonenclar, only 40 percent of Intel's total chip production, and almost exclusively the 8088, goes for personal computers. Intel's 16-bit 8086 is much more versatile. Sando of Intel happily reels off a list of 8086 applications: 80 percent of Japanese desktop computers are 8086 based, for example, and Ford Motor Company uses 2 million chips a year in its electronic engine controllers. In addition, the 8086 chips are used in the numerical control machines and robots for automated, flexible manufacturing, for high-end terminals, word processors, and medical instrumentation.

"The 8086 has been available for 4 years (both from Intel and second-source suppliers), but demand is continuing to grow. Our production increased by a factor of 3 from 1982 to 1983, and it's likely to increase nearly that much again this year," Sando says.

New deals or no, Intel's processors are still raking in the chips. ■

## A Cathedral of Computer Art

Where but in Manhattan would a church turn into a high-tech in-spot? That's the site where over a thousand computer-graphics professionals will attend Graphix Systems 84, a day-long workshop and exhibition on Wednesday, May 21, beginning at noon. The workshops will include demonstrations of computer-aided design (CAD), animation, and image processing.

Graphix Systems 84 is being held at an appropriate site, a place where cultural traditions collide with state-of-the-art technology. It's The Limelight—a trendy entertainment complex built into what used to be the main cathedral of a landmark New York City church, located at 660 Avenue of the Americas. The exhibition will conclude with a live performance involving real-time image processing and a laser light show.

Graphix Systems 84 will be hosted by the New York Siggraph, a nonprofit organization of computer artists, producers, and programmers. To register for the show, contact Richard Horner at (212) 807-8050. ■

## How Other Languages Mind Their Millionths

Several issues ago, we pointed out an arithmetic peculiarity of Microsoft BASIC. (See "What a Difference a Millionth Can Make" in PC, Volume 3 Number 1, page 55.) When you run:

```
PRINT INT(2.6*7–0.2)
```

the result isn't 18, as you might expect—Microsoft BASIC knocks it down to 17.

Why? As we explained in "Making BASIC Mind its Millionths" (PC, Volume 3 Number 8, page 39) conversions between decimal and binary forms of numbers during calculations involve roundoff errors that result in a value slightly less than 18. Then, when the INT function truncates that value, the integer result is 17. (Note that the CINT function would have rounded off the value to a proper 18.)

We tried to find how small the error was by substituting smaller values for 0.2. We found that using 0.199999 gave a correct result of 18, but the result was 17 when we used 0.1999999. A mere millionth made that much difference.

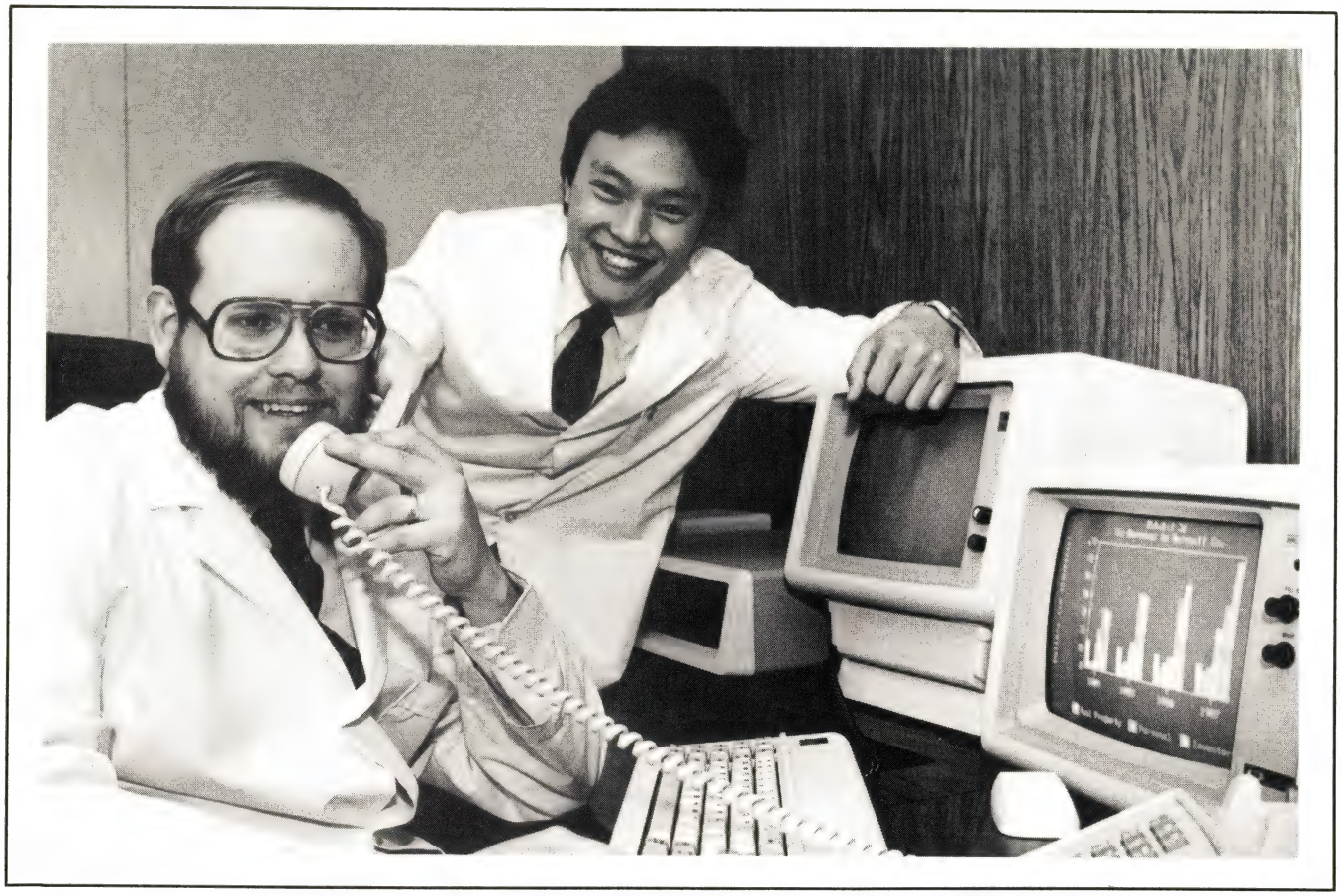
From Ontario, Dr. G. J. Lastman of the University of Waterloo sent us the results of tests he did to see how different versions of FORTRAN and Pascal for the IBM PC handled four variants of this BASIC problem. This table shows his findings. Here's more proof that, even in arithmetic, computers are no more accurate than you ask them to be. ■

| | IBM BASIC | IBM FORTRAN | UCSD p-System FORTRAN (SYSTEM2) |
|---|---|---|---|
| INT(18.2–0.2) | 18 | 18 | 17 |
| INT(2.6*7.0–0.2) | 17 | 18 | 17 |
| INT(2.6*7.0–0.199999) | 18 | 18 | 18 |
| INT(2.6*7.0–0.1999999) | 17 | 18 | 17 |

| | Microsoft Pascal | IBM Pascal | UCSD p-System Pascal (SYSTEM2) |
|---|---|---|---|
| Trunc(18.2–0.2) | 17 | 18 | 17 |
| Trunc(2.6*7.0–0.2) | 18 | 17 | 17 |
| Trunc(2.6*7.0–0.199999) | 18 | 18 | 18 |
| Trunc(2.6*7.0–0.1999999) | 18 | 17 | 17 |

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# Seequa Portable Plays 3.25 Disks

## Kaypro sales managers defect as both companies ready new computers

BY JAMES LANGDELL

ODENTON, Maryland—In nature, a chameleon blends peacefully into its background. However, Seequa Computer Corporation, maker of the Chameleon computer, stands in the foreground of several controversies in the PC marketplace.

On one front, in the midst of debate over standards for small diskettes, Seequa introduced a new computer based on one of the formats. And, competition between Seequa and Kaypro, another bargain-priced, dual capability clone manufacturer, has escalated because nearly half of Kaypro's regional sales managers moved to Seequa.

### New Seequa 325

Seequa is the first computer maker to offer a system—the Seequa 325—with 3¼-inch disk drives, which the company says will run popular IBM-compatible programs supplied on 3¼-inch disks in the new Dysan Series Software line. (See "Dysan 3.25″ Disks With Hit Software" in *PC*, Volume 3 Number 5, page 52.)

The $2,495 Seequa 325 is much like its earlier transportable Chameleon Plus. Both have two microprocessor chips: an 8088 that handles 16-bit MS-DOS software and a Z-80 for 8-bit CP/M programs. Each computer has a 9-inch green monitor, 128K RAM, a keyboard with a PC-style layout, and two disk drives.

The Seequa 325's disk drives are smaller and weigh less than the standard 5¼-inch drives on the Chameleon Plus, but only trim 3 pounds off the old machine's 28-pound bulk. Seequa is using the old chassis design in the new machine. The leftover space is now only a diskette storage slot, but it could hold another 3¼-inch drive, or a thin 5¼-inch drive or hard disk, a spokesman said.

In addition to taking up one-third the volume of regular 5¼-inch drives, the 3¼-inch drives use one-third the power. Ultimately these drives could be designed into a more compact computer powered by batteries—a step Seequa hasn't taken. David M. Gardner, president of Seequa, said, "We don't view the Seequa 325 as a major new consumer product. We're going for a market that's interested in using smaller drives."

### Differing Disks

Recent computers—most notably from Apple (Macintosh), Sony, Hewlett-Packard, and Gavilan—usee a different smaller diskette, one that's 3½ inches in size and enclosed in a hard plastic shell. Even though this 3½-inch style was introduced first, Gardner is confident that the 3¼-inch drives used on the Seequa 325 will become the standard for smaller IBM-compatible computers.

These drives are plug compatible with current 5¼-inch drives; they can even use the same controller cards. Gardner also claims that timing factors are identical on 5¼ and 3¼-inch drives, so software with copy-protection schemes that depended on drive characteristics need not be modified.

### Sales Switch

In the marketplace, Seequa and Kaypro have staked out similar positions. Their machines are about the same size, and about equal in convenience, whether sitting on a desktop or hanging from your shoulder. They both offer dual-processor machines. Seequa emphasizes the Chameleon's IBM compatibility, but offers its Z-80 processor as an added perk. Kaypro computers are designed around the Z-80, but with add-on boards they can run 8088-based software. And both Kaypro and Seequa are expected to come out with IBM-compatible lap-sized computers this year.

Even though the two companies look the same from the outside, many of Kaypro's regional sales managers seem to find significant differences.

"I made no phone calls—I just took phone calls," said Gardner, who recently hired six of the 13 regional sales managers. "That was unusual, to have virtually an entire sales force approach us." Did Seequa offer better salaries? "No, but they believe they'll sell more units, and on a commission basis they'll do better here."

Gardner claims that the emigrating sales managers were uncomfortable about Kaypro's new product line. Whether Seequa and Kaypro will have more surprises for each other—and computer users—remains to be seen. ■

# Lap-sized Compatible From Kaypro via Japan

SOLANA BEACH, Calif.—Kaypro's rise has been one of the rare non IBM-compatible success stories of the past 2 years. But, with its recent announcements, however, Kaypro Corp. has moved into the 16-bit camp. This summer it expects to deliver a lap-sized, "ultraportable" IBM-compatible computer, and now offers an optional 8088 processor for its standard 8-bit machines. Kaypro has already announced an IBM-compatible transportable system, for delivery this spring.

The lap-sized machine is being developed by Mitsui, a Japanese manufacturer. This project involves Kazuhiko (Kay) Nishi and a team that also developed the popular Radio Shack TRS-80 Model 100 and its built-in software.

The battery-powered Kaypro computer will include a desktop module—a base unit with greater storage and power for whenever the computer returns home. (A similar option is now available for the Model 100.) The desktop module will include expansion slots for IBM-compatible boards. Unlike previous Kaypro machines, the "ultraportable" probably won't include 8-bit capabilities based on a Z-80 coprocessor.

Kaypro hasn't set a price for its lap machine, but it's expected to be at the "high-end" of its product line. The company plans to unveil the new model at the July NCC show in Las Vegas.

Kaypro's present 8-bit computers also can join the IBM-compatible bandwagon. The Kaypro 4 is now available with the "Plus 88" option, which adds a board with an 8088 processor and additional memory. (The 8088 can't use RAM already built into the Kaypro, but the memory added on the 16-bit card is treated as a RAMdisk when the computer is in 8-bit mode.) The Kaypro 4 Plus 88 costs $2,395—about $400 more than the standard 8-bit model. With this option, Kaypro supplies only MS-DOS and RAMdisk software on a disk—no documentation at this bargain price.

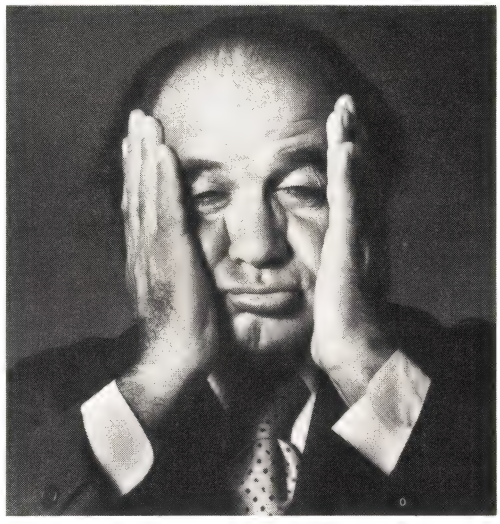
Currently Kaypro offers this upgrade only on its Kaypro 4. Third parties, such as SWP Inc. of Arlington, Texas, offer 8088 conversion kits for other Kaypro models, including the Kaypro II, the hard-disk Kaypro 10, and the Kaypro 484 (an improved version of the Kaypro 4) for between $500 and $600.

When it entered the computer marketplace 2 years ago, Kaypro stepped into the transportable footsteps of Osborne Computer Co.—and has stayed on a profitable trail long after that pioneer lost its footing. The question this year: Can Kaypro stand toe-to-toe with IBM without getting stomped?

***—James Langdell***

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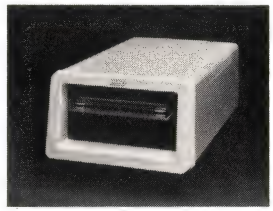
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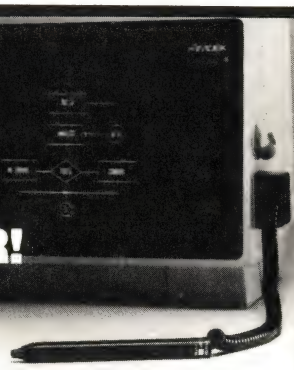
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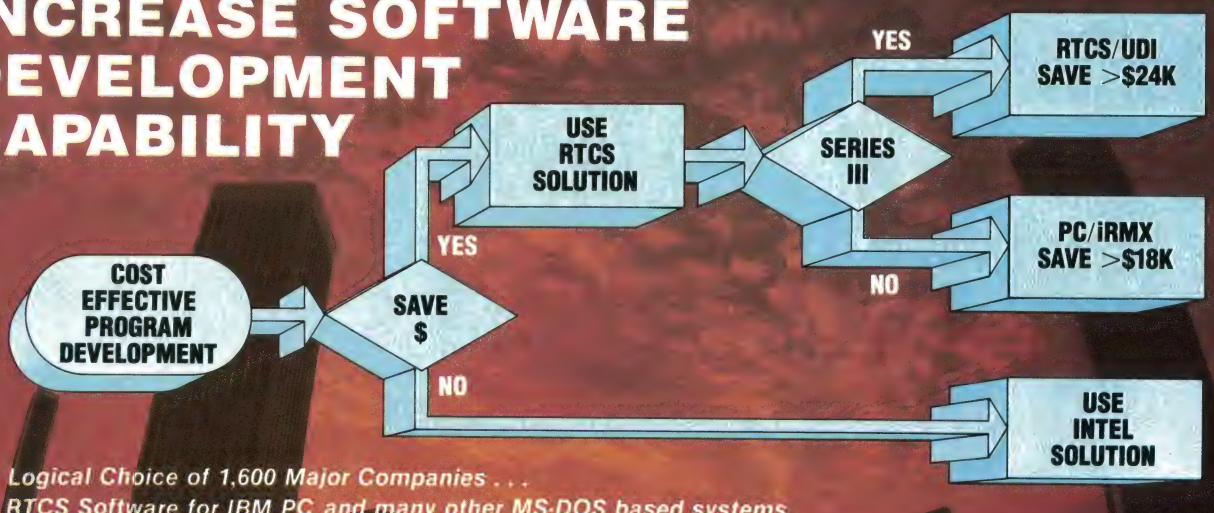
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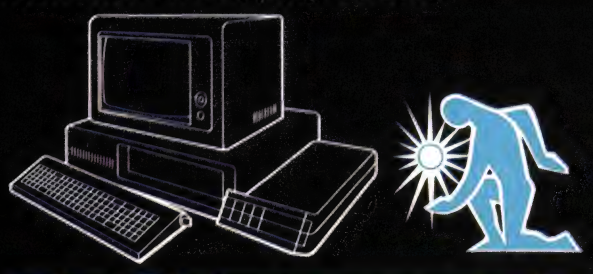
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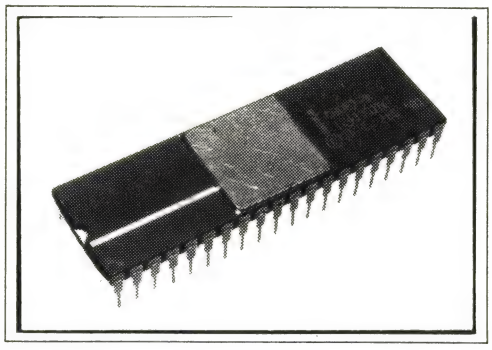
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MOUNTAIN VIEW, Calif.—With its new PC-3, Colby Computer has gone from making PCs portable to making portable PCs.

What's the difference? Originally Colby offered to take a customer's desktop IBM PC and repack its hardware into a transportable chassis with a built-in 9-inch monitor. (That's one way to assure that your computer is truly IBM-compatible: Start with a real IBM PC.) Colby also manufactured an alternative keyboard for the IBM PC, which was attached to Colby's PC-2 transportable computer. (See "Porta-Packing Your PC," *PC*, Volume 1 Number 9.)

The new PC-3 is a transportable PC-compatible similar in appearance to Colby's rebuilt PC-2, but the parts for this computer come entirely from Colby's own shelf. Now Colby produces its own IBM-compatible motherboard that can hold as much as a megabyte of RAM. The motherboard also provides a serial port, parallel port, hard disk interface, and real-time clock. Enough space remains for add-on slots; the Colby PC-3 can handle three full size boards and one half-length board.

With its narrower keyboard, the Colby chassis is more compact than the IBM Portable PC or the Compaq. Colby's machine is 8¼ inches high, 16½ inches wide, and 16¾ inches deep. Its width is about 5 inches less than most other transportables—inches that can make "the difference in getting it under an airline seat," says Chuck Colby, company president.



*The Colby PC-3 is only 16.5 inches wide—trim enough to fit under an airline seat.*

The standard PC-3 weighs 26 pounds and is equipped with a 9-inch amber monitor, two half-height 360K disk drives, and 128K RAM. Price: $2,795. Colby's PC-1 and PC-2 conversions and keyboard are still offered, and the PC-3's motherboard will soon be available separately for $799.

Colby Computer is at 849 Independence Ave., Mountain View, CA 94043, (415) 968-1410. ■

# MIDNIGHT COMPUTER SUPPLY



Someone down on the Strip (Sunset Strip) spilled to us about Take A Byte, a computer store in Westwood, California. We heard it was peddling software and pushing hardware far into the night. Was this on the level? We wanted an investigator to suss it out. We dropped a dime on Fred Hammler and put him on the case.

Fred took the assignment with about as much joy as a batter takes a strike. But he went. Fred's nights were slow. Every thug he knew had turned to computer crime. The back of his skull hadn't been sapped in weeks.

A messenger with green shades and an orange jumpsuit dropped off the first scrawled report. The store was open until 10 p.m. on weeknights. But on weekends, the action didn't stop until midnight. The joint was jumping with sure buyers, browsers the owners called "lookey-loos," and users who sat down with one of the micros from the store's stable—there were models for every taste. The management nibbled at these users to the tune of only four bucks an hour for rent. If this was a racket, then where's the byte?

Fred tailed some of the terminals, but none of their menus got around to offering an option like, "Why don't you order me some pink champagne?"

Take A Byte's clientele was diverse. Students from UCLA grinding out term papers. Parents who came home to find broken disk drives mingled with Hollywood screenwriters just off the sets. International Olympic Committee organizers ran over when their system crashed.

Next day, Fred logged off the case. The joint kept funny hours, but was clean as bubble memory. Fred said he still didn't know what his pals at the wrong end of the Boulevard (Hollywood Boulevard) saw in the silicon game.

Apparently, however, there's a high-tech bug at Take A Byte, and it bit Fred hard. Today we got a hard-boiled diskette in the mail. No label, but we knew it was from Fred. We booted it up. Gunshots spit out of the PC's tiny loudspeaker. Then, after the screen cleared, it hung out this shingle. "Private shamus for hire. Packing 256K and the fastest hardware. Will follow intruders onto any lines. No escape codes. Defense Department inquiries welcome."

He gave his Source number and signed it "Deep Disk." ■

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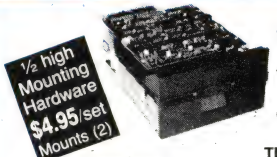
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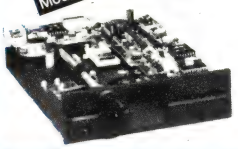
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# Print Runs Wild For PC Primers

## Shakeout question: Can publishers recoup big advances on IBM books?

BY MARTIN PORTER

The news of the spring of 1984 in the book publishing business like 1983 is that computer books are hot.

And if the spring listing published by industry trade magazine *Publisher's Weekly* is an indication, books about the IBM family of machines may well be the fastest growing category. One hundred and eleven titles dealing with various aspects of the IBM PC, the PC*jr*, and MS/PC-DOS are scheduled to hit the shelves before summer. Some industry observers expect the total count for this machine base to hit 300 books by fall.

"We anticipate tough competition," says Joe Esposito, director of computer publishing for New American Library (NAL) which has five PC-related titles in May. "But the category is continuing to grow."

The relatively small installed base of the IBM PC, compared to mass market machines like the Commodore 64 and Texas Instrument 99/4A, has led some experts to question if there is, indeed, room for this many books about the IBM Personal Computer.

But Jody Guariglia, computer books marketing chief at Prentice Hall, maintains, "IBM books are selling. The machine is setting the standard. Our books cover the entire gamut of the subject, geared to everyone from total computer illiterates to computer scientists." Prentice Hall will be publishing 19 IBM computer titles under its four imprints this spring.

### Bestsellers

Still, IBM computer books don't often appear on the bestseller list that book chain B. Dalton maintains for in-house use. Because of an installed base estimated at around 2 million machines, books about Commodore computers usually hold the top slots, while even the discontinued Texas Instrument home unit has helped sell an estimated 1 million book titles to date. The closest thing to an IBM PC book on B. Dalton's list is *Lotus 1-2-3 for Business* (Que Corporation) at number four.

Nevertheless, B. Dalton marketing manager Tom Bennett is confident that there is a market for the multitude of IBM books on their way. "Those three initials are extremely important," he explains.

Booksellers are also encouraged by a high book-to-machine base ratio for upscale market computer products. For example, to date 125,000 packages of *Lotus 1-2-3* have been sold while an estimated 70,000 books on the topic have also traveled out the bookstore door, for a 60 percent book sale-to-installed base ratio.

### Hardware Figures

Other figures encourage book editors about the IBM book marketplace, too. They point out that for every disk drive machine sold, four to seven books about it have already been bought and read. With an estimated 3 million IBM computers expected to be sold by 1985, the optimistic side would predict sales of 21 million books about the IBM PC. Even if that number were halved, computer books on this topic alone would warrant the current book title surge.

"It is clearly unprecedented," says one high level computer book publisher who asked not to be identified. "Nobody understands it. Nobody has ever seen anything like it before."

There are those book business experts who predict a computer book shakeout by next fall, a time when the six figure book advance titles will begin to show sales figures. Some of the earliest and most-celebrated book contracts last season included $1.3 million for Stewart Brand's computer age rewrite of the *Whole Earth Catalog*. The largest IBM book deal was the $800,000 advance for the *PC World Reference Library*.

### Shakeout?

"By this time next year heads will roll in the publishing companies. Blood will flow on Third Avenue in New York [publisher's row]," predicts Nahum Stiskin, publisher of Microsoft Books, which are distributed by Simon & Schuster.

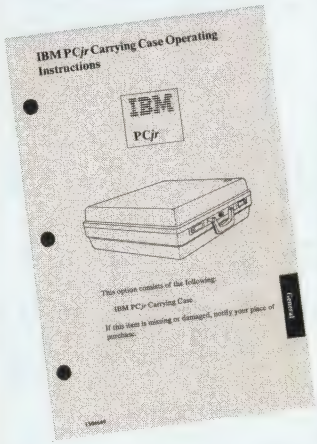
Stiskin is also pessimistic about whether the market can bear so many IBM PC titles. "There will be a shakeout," he adds. "The me-too product won't sell. The books that will sell are those that are good. The key to publishing is the backlist. The books that become classics are those that are good, not the first out."

Judging by the repetitiveness of this season's IBM PC titles, not everyone agrees.

There will be two books entitled *How to Use the IBM PCjr* (Alfred Publishing, Dilithium Press) in the book racks this spring. There will be two *Reference Encyclopedia for the IBM Personal Computer* (Ashton-Tate Books and Prentice Hall); interestingly, both are written by the same author. Besides the title clones, there is also an *IBM PCjr User's Guide* (Macmillan), *IBM PCjr User's Handbook* (Ballantine), and an *IBM PCjr Buyer & User Guide* (Prentice Hall). ■

## It's a Clear Case of Manual Overkill in PCjr's New Carrying Case

When IBM introduced the PC*jr*, the company knew that it would be serving a new set of customers—home users—who might have had no computer experience before buying a PC*jr*. To keep these new IBM owners happy, Big Blue's documentation department seems to have put a lot of effort into writing manuals with thorough instructions for the PC*jr*, its software, and its accessories.




IBM's documentation team went all-out when it created the manual for one product. The IBM PC*jr* Carrying Case, priced at $60, comes with a 14-page booklet of operating instructions.

If you want to learn how to pack the PC*jr* in its case, just follow the documentation's 24 simple steps, which are amplified with six illustrations. Once you've mastered this skill, another nine-step lesson will show how to set the carrying case's combination lock.

I hope that IBM's explanation was thorough enough so that no third-party publishers will think there's a niche for books with titles like *Mastering the PC*jr *Carrying Case*.

IBM's manual ends with a warning. "You may damage your system if you use this case as a shipping container. You should keep the original packing material and use it if you need to ship your system." To be on the safe side, we're waiting to see a copy of IBM's documentation for its PC*jr* cardboard boxes. ***—James Langdell***



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CIRCLE 802 ON READER SERVICE CARD

# Softyme Bids for Share in Electronic Distribution

BY CONNIE WINKLER

SAN FRANCISCO—Electronic distribution of software is the latest emerging channel of distribution in the software industry. Perhaps, because of the newness—there's no consensus among vendors on which technique works best. Indeed, they are all still to be tested in the marketplace.

Xante Corporation (a Tulsa start-up) late last year introduced a scheme that requires an almost refrigerator-sized computer station at the retail location. Micro D, a successful micro products distributor, is teaming up with AT&T to transmit software, primarily for business, over AT&T's (long) coming information services network.

A new arrival at the electronic distribution party is Softyme, a joint development effort of Tymshare, Inc., which plans to deliver PC software over Tymshare's giant national packet-switched network. Software will be downloaded at high speeds (56 kilobits a second) to a PC or PC/XT in the retail store, said Robert Colten, the former Tymshare executive now heading Softyme.

There are a couple of added twists: At the time of purchase diskettes will be serialized with the purchaser's name, and there will be a retail-focused support service that also uses Tymshare's mainframe computers.

### Piracy Hook

Putting the original purchaser's name "Frank" on the diskette—readily visible when "Carl" boots the program—is "shaming people into behaving." That's Softyme's response to the software pilferage issue, Colten says.

"Eighty percent of customers' questions can be answered electronically," explains Colten about the service plan. Software customers would call their retail store, which would get the answer quickly over the network. Those toughie problems would be passed along to support personnel at Softyme.

Softyme is being tested in four chain locations in California, Colten says. It's expected to be installed in 16 stores on the West Coast and in Chicago by the fall.

Softyme will provide the retailer with the master PC and the communications and formatting capabilities. The system will also print out disk labels and a "mini-document" to get the user started using the program. Within 3 days the purchaser will be mailed the full manual by overnight delivery from the nearest regional Tymshare office, Colten says.

### Service Focus

"We're putting the retailer back in control—making the store the place of support," said Colten. "That is what makes us different." He also anticipates that store-based users groups might ultimately take advantage of the Softyme network.

Softyme initially plans to handle about 70 packages for the PC, and ultimately as many as 500. There will be versions for IBM compatibles and maybe for Apple computers as well. ■

# Softrend Emanates Integrated Aura

BY STEPHANIE STALLINGS

Softrend, Inc. is a young company from Salem, New Hampshire, which has just completed its integrated software package, *Aura*.

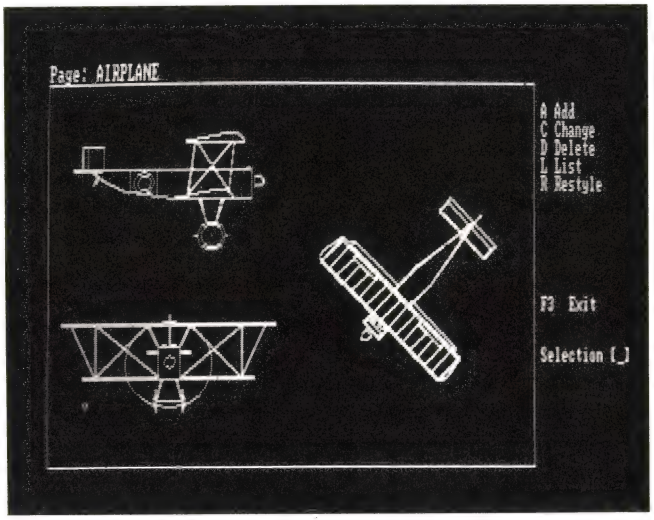
*Aura*'s functions seem to stand well on their own. The focus of the package is its database manager, which features a select/sort function, a report function, and a menu-creation facility to create a user interface.

The graphics function includes the usual selection of bar and line graphs, and pie charts. In addition, it features a very handy free-form graphics facility. A menu in the upper right quadrant of the screen lists the shapes that can be selected, such as a circle, polygon, or arc. These shapes can be moved around the screen, rotated, and changed in size by placing the cursor inside the form and choosing the appropriate command from the next menu on the screen.

*Aura* has a spreadsheet and word processor that we were assured are quite respectable. The package's fifth function is devoted to combining the other four. While editing a text, you can identify any graphs and spreadsheets that you wish to include with the text. Space is automatically set aside within the text for placement of the graphs and spreadsheets. These items are printed out within the text.

According to Michael Hassell, product marketing manager, *Aura* will be released on May 25 and will be available through computer stores.

For more information, contact Softrend, Inc., 2 Manor Parkway, Salem, NH 03079, (603) 898-1777. ■



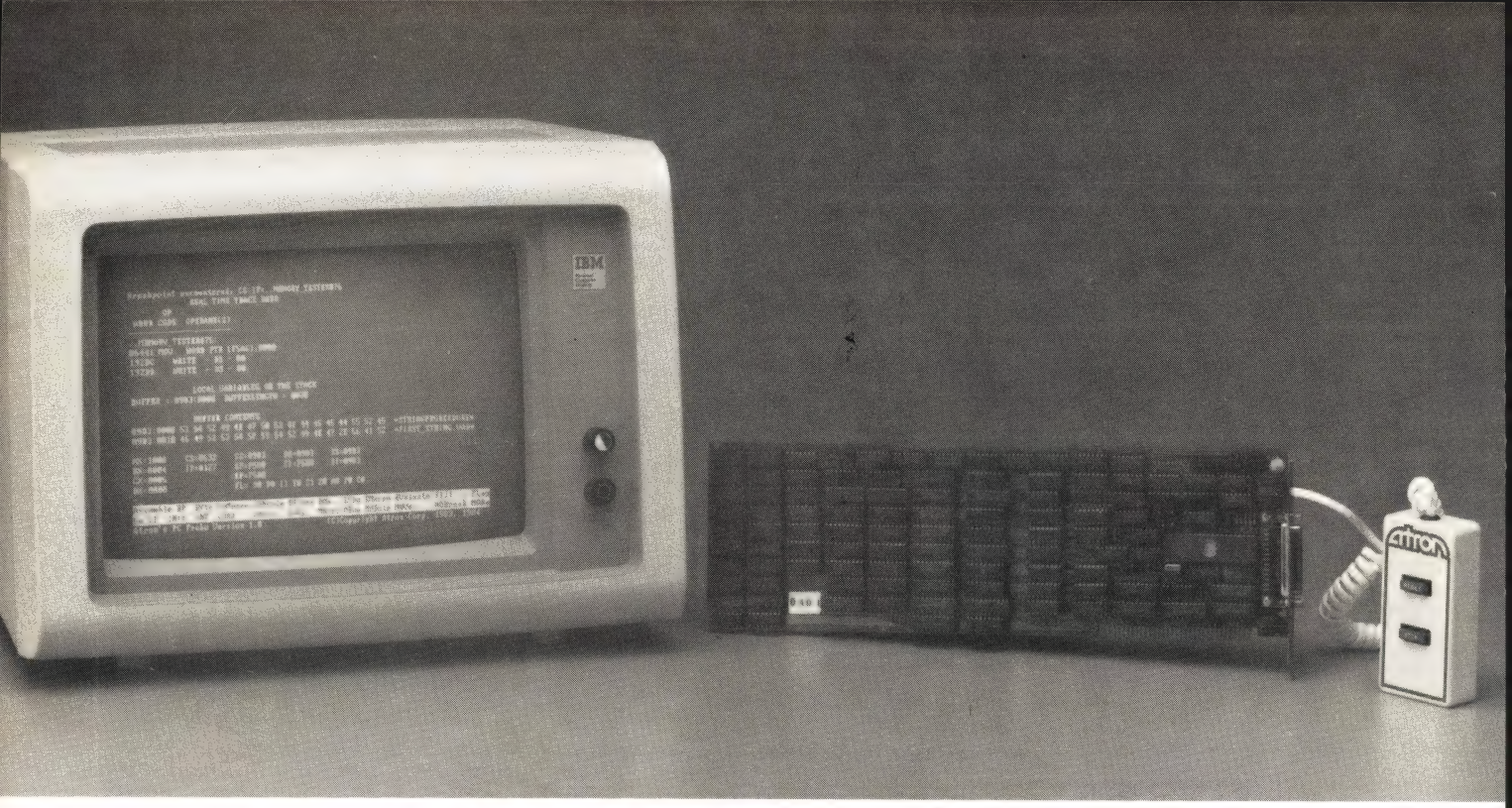

*The graphics functions in the* Aura *integrated software package go beyond graphs and charts, it's plain to see.*

## 'Charge It'

BOCA RATON—"Some people wanted to pay cash," says Victor J. Goldberg with chagrin, recalling some of the first customers at the IBM Product Centers, part of the IBM division he heads. IBM was obviously not used to selling to the public when it went retail in 1981, but the computer giant is learning.

Now there's an IBM Credit Card—silver with black embossing—for use at the Product Centers and backed by the IBM Credit Corp. Anyone spending a minimum of $300 can fill out an application, get a card, and use it immediately, said a Credit Corp. spokesman in Old Greenwich, Connecticut.

The IBM cards, like any credit cards, have ramifications. By offering a consumer credit card, IBM Credit Corp. "could eventually get hundreds of millions of dollars in interest payments," said Hesh Wiener, an IBM watcher in New York. He compares IBM's financing to automobile company plans: "The interest rates are higher than they would be for a bank loan, but you get instant credit approval." ■



# ATRON Announces A State of the Art Advance in Software Debugging—PC Probe

**PROGRAMMERS AND MANAGERS** know that finding bugs during new product development and over the entire product life cycle adds up to a significant portion of total product development cost and support time. Investing in the right debugging tools will greatly improve time to market as well as minimize development cost. Atron Corp. has the right debugging tools for the PC environment. These are:

1) PC PROBE
2) SOFTWARE PROBE
3) PERFORMANCE ANALYZER

PC PROBE plugs into a PC or compatible. It is a total system debugger with features like:

**Real Time Trace**
Program flow is saved in trace memory while running at full speed. PC PROBE can display trace data as high level language line numbers, procedure names etc. — or as 8088 instructions. In addition, DMA cycles, interrupt lines and external logic probes can be traced. Real time trace answers the question "How did I get here"?

**Memory Protection**
What good is a debugger that can be wiped out by an undebugged program? PROBE software is write protected and can't be changed.

**Hardware Breakpoints**
The PC PROBE has 8 breakpoints and can trap conditions such as instruction execution, read, write, IO, DMA, interrupt, or external logic probes. Breakpoints can also be set on ranges of address or data — symbolically too!

**Enhanced Human Interface**
The PC PROBE designers know the importance of EASE OF USE. The PC PROBE interface has a menu window which displays the syntax of each command — so you never have to remember how a command works. It also recalls the previous invocation of each command to save tedious typing — and tedious thinking!

**Symbolic Debugging**
Avoid the tedium of sifting through link maps to find out where things are. The PC PROBE uses your program symbols.

**Macro Commands**
Why be limited by a fixed set of debugging commands? PC PROBE lets you create your own powerful macro commands with parameter passing, nesting, LOOPING and IF/THEN/ELSE control.

**ANNOUNCING SOFTWARE PROBE**

The same great software used on PC PROBE is now available separately as SOFTWARE PROBE —

**ONLY $295**

Software probe is the only software debugger available which provides a hardware reset and break box for program crash recovery. What good is a software debugger if you can't get control of run away programs?

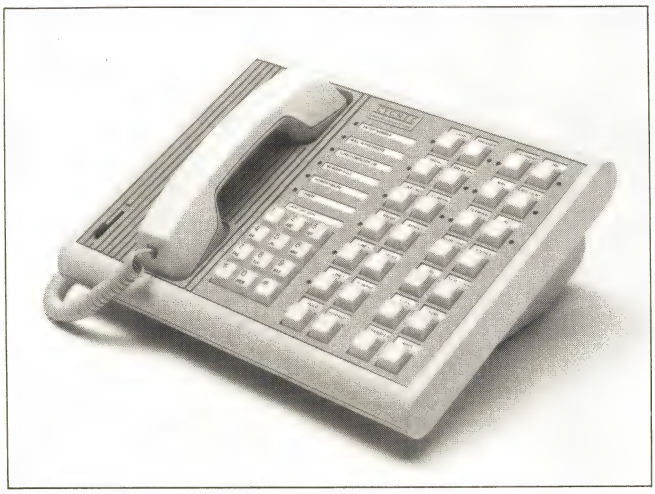
**PERFORMANCE ANALYZER**
How do you find time critical program problems or know where to start performance tuning your software? Get Atron's new Software Performance and Timing Analyzer. Then you can display histograms of how your programs run — by time or by events. You can perform many different timing measurements.

Atron has many happy customers who have made critical product schedules because of PC PROBE. Why waste time on primitive debugging techniques? — Call us today and ask for your 12-page data sheet. Manuals also available for $25.

atron

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CIRCLE 156 ON READER SERVICE CARD



# It's More Than a PC And More Than a Phone

## All an executive's communications needs could be served by the Cygnet CoSystem

BY STEPHANIE STALLINGS

Dr. Federico Faggin is an elder statesman of the microcomputer field. He created the first microprocessor chip for Intel and founded Zilog, Inc. Now, Faggin and his partners, Jerry A. Klein and Lauren F. Yazolino, have started a new enterprise.

Their company, Cygnet Technologies, Inc., based in Sunnyvale, California, is marketing an "integrated voice and data communications system" for the IBM PC that may be in direct competition with some of AT&T's products.

The purpose of the Cygnet Communications CoSystem is to gather an executive's communications tasks under one electronic roof.

The CoSystem includes hardware consisting of a telephone handset, 12-key dialer, and 28 additional buttons. The unit looks like a conventional telephone on the outside, but inside the box is a full-fledged Z-80 microprocessor chip and a modem. The CoSystem unit uses the IBM PC's screen to interact with the user.

You can use the CoSystem to send electronic mail, or, if you prefer, you can send one screen of information at a time as part of a telephone conversation, enabling everyone involved to comment on it at once.

The CoSystem allows an extensive directory of telephone numbers to be stored in memory, and it also has automatic redial, call transfer, and call forwarding capabilities. The Communications Management System keeps a log of all telephone and electronic mail communications. If you stop to use the CoSystem while doing other work on your PC, at the end of its use the CoSystem will return you to the place you left off. The CoSystem also includes terminal emulation.

All of these features can be customized using the accompanying diskettes. One program lets you set up and store procedures so you can access data services, such as CompuServe, without repeating the log-in procedure.

The 300-baud version of the Cygnet CoSystem is priced at $1,495, and the 1200-baud version at $1,895. For more information contact Cygnet Technologies, Inc., 1296 Lawrence Station Rd., Sunnyvale, CA 94089, (408) 734-9946. ■

# NEXIS Adds Time

NEW YORK—Seven of Time-Life's magazines will be available on NEXIS, the news and general information on-line database from Mead Data Central beginning in 1985.

It is appropriate for *Time*, "the magazine that chose the computer as the 1983 Man of the Year," to begin publishing electronically, said Larry M. Crutcher, Time Inc.'s vice president of magazines.

Editorial information from Time Inc.'s weekly publications, such as *People*, will be added to NEXIS within 2 days of the cover date. News from monthly publications, such as *Money*, will take a little longer.

In order to search and retrieve information from NEXIS, subscribers must use Mead's UBIQ terminal, the IBM PC, the IBM Displaywriter, or the IBM 3101 terminal.

On April 1, Mead will change its pricing. Instead of charging for each search unit, the search charges will be fixed. "Subscribers can afford to ask the question and receive the full answer," says Jack W. Simpson, president of Mead. A user can search the entire NEXIS database files for $18 during peak hours and $9 during off-peak hours, which are between 7:30 p.m. and 7:30 a.m. Searching an individual magazine, such as *Fortune*, will cost the user $9 per search, $4.50 during off-peak time.

In addition to search charges, the user must pay connect-time charges (which have been dropped to $20 per hour), telecommunications costs, and a monthly subscription charge. Mead will offer various discount rates, ranging from 4 percent to 32 percent off, to users who use NEXIS to conduct a large volume of peak-hour searches.

As an added feature, Mead will provide an electronic clipping service called ECLIPSE. ECLIPSE will be particularly attractive to users who consistently track the same type of information and news. Users can track pertinent topics and trends on a daily, weekly, or monthly basis and have the ECLIPSE search results delivered automatically through dedicated high-speed printers or mailed from the company's main offices in Dayton, Ohio.

Weekly and daily ECLIPSE search costs are less than the normal search price. For example, making a daily search of the entire NEXIS database using ECLIPSE costs just $216 a month.

Mead also supplies LEXIS, a popular computer-assisted legal research database. ■

## Sofstar Inc.'s Business Planning Tool Turns Worksheets into Templates

JUNO BEACH, Florida—What's easier than A-B-C and works with *1-2-3*? The answer is *BPT*, the *Business Planning Tool*, from Sofstar Inc. *BPT* develops worksheets that calculate and forecast income, expenses, assets, liabilities, and equity. *BPT* can project financial trends 12 months into the future and also permits "what-if" calculations, says Ward Flynn, Sofstar's vice president for marketing.

Even better, Flynn explains, completed worksheets are automatically formatted into templates that can be integrated into more powerful Lotus *1-2-3*, *VisiCalc*, or *Multiplan* programs.

*BPT* doesn't force users to act like machines, Flynn says. *BPT's* natural English commands are easily understood by people operating in "normal human mode." Because all worksheets are formatted automatically, using *BPT* requires virtually no computer experience.

Sofstar's *BPT* runs on IBM PCs or compatibles with 128K RAM. *BPT*'s price: $225. ■

# Calendar of Events

| DATE | EVENT | COMMENT | LOCATION | CONTACT |
|---|---|---|---|---|
| May 10-12 | SOFTWEST '84 | Hardware and software for Apple and IBM PC computers. | Regency Hotel and Conference Center Denver, CO | Colorado Conference Group 3312 Cripple Creek Suite C Boulder, CO 80303 (303) 499-1034 |
| May 15-17 | Criminal Justice Systems Conference | Criminal justice applications. | Virginia Commonwealth University Richmond, VA | Virginia Department of Criminal Justice Services 805 E. Broad St. Richmond, VA 23219 (804) 786-4000 |
| May 22-25 | COMDEX/Spring | Hardware, software, and accessories for dealers and retailers. | Georgia World Congress, Atlanta Apparel Mart, and Atlanta Merchandise Mart Atlanta, GA | The Interface Group 300 First Ave. Needham, MA 02194 (800) 325-3300 (617) 449-6000 |
| May 22-26 | MICRO-EXPO | International hardware and software trade show. | Palais des Congres Paris, France | MICRO-EXPO 2344 Sixth St. Berkeley, CA 94710 (800) 848-8233 (415) 227-2346 |
| June 12-14 | Advanced Manufacturing Systems Exposition & Conference | Information systems and automated production systems. | McCormick Place Chicago, IL | AMS 84 708 Third Ave. New York, NY 10017 |
| June 13-15 | Use of Microcomputers in Occupational Safety and Health | Seminars on how to select and use micros for safety and health data collection, analysis, and retrieval. | University of Washington Seattle, WA | University of Washington Seattle, WA 98195 (206) 543-1069 |
| June 14-17 | Cincinnati Computer Showcase Expo | Hardware and software. | Cincinnati Civic Center Cincinnati, OH | The Interface Group See above |
| June 15-17 | Computerfest '84 | Exhibits, seminars, and hardware trading. | Dayton Convention Center Dayton, OH | Mid West Affiliation of Computer Clubs P.O. Box 24505 Dayton, OH 45424 |
| June 18-21 | The National Database and 4th Generation Language Symposia | Product-oriented discussions and seminars. | Stouffer's Inn of Westchester White Plains, NY | Software Institute of America 8 Windsor St. Andover, MA 01810 (617) 246-4280 |
| June 20-22 | Project Planning, Scheduling & Control Using PCs | Hands-on workshops to help upgrade productivity and effectiveness with the help of PCs. | AMA Management Center Washington, DC | American Management Association P.O. Box 319 Saranac Lake, NY 12983 (518) 891-0065 |
| June 21-24 | Boston Computer Showcase Expo | Hardware and software. | Hynes Auditorium Boston, MA | The Interface Group See above |

# Even your favorite software can have annoying personal habits. Get ProKey.

If you're like most of us you probably own an IBM PC and a closetful of popular software. Maybe Wordstar, Visicalc, dBase II and a few others. And with each program comes its own peculiar protocol, commands and demands.

Suddenly you've become a personal slave to your personal computer.

Free yourself with ProKey.™

ProKey is unlike any other software because it operates just about any other software. So you can spend your time creatively while ProKey takes care of the tedious operational details. Silently, instantly, without errors.

ProKey can print spreadsheet tables, update databases, reformat reports and plot graphics and still leave you time to train for the triathalon or run out for a danish.

In fact, ProKey can memorize and execute anything you can type.

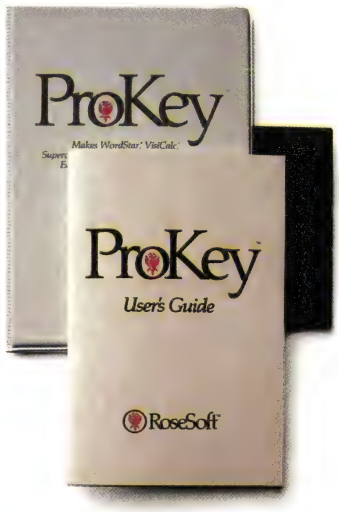
And no matter how extensive your software collection becomes ProKey controls them all, with one easy to remember protocol.

With all the time you save you'll be able to customize off-the-shelf software to your own personal or business requirements.

Ultimately you'll use ProKey as a "super-command center" operating your own software programs together to create a totally unique, incredibly creative system.

ProKey is available at most Computerland stores and wherever fine software is sold.

Once you use ProKey you'll never curse your cursor again.




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To run ProKey, you'll need an IBM Personal Computer or workalike DOS (any version, including 2.0), and 64K of RAM (WordStar requires 96K).

WordStar, VisiCalc and dBase II are trademarks, respectively, of Micro Pro, Visicorp and Ashton-Tate.

PRODUCT REVIEW

# Some Cracks in VisuALL's Windowing, Mouse Package

BY JAMES LANGDELL

**VisuALL**
Trillian Computer Corp.
Box 481
Los Gatos, CA 95031
(408) 374-5001
**List Price:** $99.95; *WordStar Shell,* $49.95
**Requires:** 64K RAM, one disk drive.

Last year, software with windows—any windows—seemed like a great idea. And, if you made a better mouse interface (or at least something cheaper than Lisa or *Visi On*) the world would beat a path to your windows.

*VisuALL* was perhaps the first piece of IBM PC window and mouse software to be delivered. Trillian's product had a modest price, and it set out to do a more modest set of tasks than other interface systems. *VisuALL*'s purpose is to save novice PC operators from having to memorize commands for PC-DOS, *WordStar,* and other programs. Instead, windows appear with lists of possible operations, and you can choose an action by moving the cursor onto its name and pressing a button. You can also call on help windows with on-screen explanations of programs and commands. The basic *VisuAll* package includes a profile for PC-DOS. Trillian provides "shells" for applications programs (so far *WordStar* and *1-2-3*) at additional cost.

You can use a mouse with *VisuALL*. The cursor follows the mouse's movements, and you can press buttons to select options or mark positions on the screen, say, to indicate a block of text to be moved in *WordStar. VisuALL* is pre-set for four mouse models: USI, Logitech, Mouse Systems, and Microsoft. The mouse, however, is optional; anything that the mouse does can also be done from the keyboard, using the cursor and function keys.

In fact, the entire *VisuALL* system is something a user can take or leave alone. Its windows appear only when you ask for them; they don't get in the way of using an operating system's or applications program's original keyed-in commands.

## Take It or Leave It

Now that I've tried *VisuALL*'s primary PC-DOS shell and its shell for *WordStar,* I can say that I'd probably leave them alone. The first set of software Trillian sent me late last year simply didn't work. When I made selections from windows, *VisuALL* would make mistakes when entering the actual PC-DOS commands. For example, after I asked *VisuALL* to list files on drive A:, the interface software stuttered and entered "diir a:", resulting in an error message from PC-DOS.

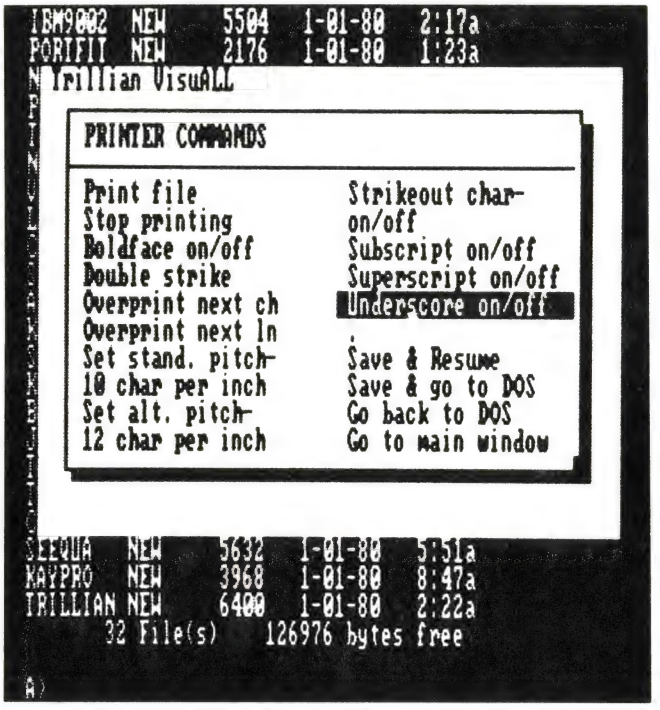
Recently I received a cleaned up version of *VisuALL* (along with a visit from *VisuALL* representatives). The stuttering was cured and the program worked as its makers intended. Still, at its present best, a beginner won't have an easier time learning to use PC-DOS-plus-*VisuALL* than to use PC-DOS itself. The descriptions of operations in the command windows explain little more than the names of the commands themselves, and the items in the windows are listed in a somewhat haphazard order. A new user would often have to translate between *VisuALL* prompts and the actual PC-DOS commands—effort that would be better spent learning PC-DOS in the first place.

## A WordStar Mouse

*VisuALL*'s shell for *WordStar* was more interesting, simply for the novelty of using a mouse with MicroPro's software. It took a steady hand on the mouse, however, to position the cursor in text because the cursor tended to drift onto higher or lower lines. The mouse could make it easier if you had to do a repetitious editing task, say, adding control characters for underlining.

If you simply handed a first-time PC user a box with *VisuALL,* straight off the shelf, I don't think this software aid would answer more questions than it would raise. Trillian's product does have the virtue of being easy to modify by an experienced user. The disk files with *VisuALL* profiles for PC-DOS, *WordStar,* and other programs can be edited to include a user's favorite commands and prompts.

The *VisuALL* manual explains how to use Trillian's set of window and mouse commands to write original profiles that suit other programs. A programmer who wants to get a taste of writing programs with windows and mice, could get his money's worth from Trillian's product by experimenting with software tools in the *VisuALL* environment. For the rest of us, however, these windows and mice have yet to prove themselves to be an IBM PC user's best friends. ■




*VisuALL offers windows that list operations you can select at the press of a button. Unfortunately, it also lets you do things like display the above window of* WordStar *commands while you're still in PC-DOS, which only confuses matters.*

```
window (DOS COMMANDS)
   Copy file          =   clear 'copy ' fprompt(Copy from file: ) +
                          ' 'fprompt(Copy to file: )enter
   Delete file        =   clear 'del ' fprompt(Delete file name: ) +
                          sprompt(Are you sure? \(y/n\): ) +
                          response(y) enter +
                          response not(y) c-c
   List files on a    =   clear 'dir a: /p' enter
   List files on b    =   clear 'dir b: /p' enter
   List files on c    =   clear 'dir c: /p' enter
   Rename file        =   clear 'ren 'fprompt(Rename from file: ) +
                          ' 'fprompt(Rename to file: ) enter
```

*A portion of the file called on by* VisuALL *to prompt and execute PC-DOS operations. This "profile" can be edited to display more extensive prompts and do other tasks.*

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Levels II, III, and IV have a depreciation module and automatically compute underpayment penalties and minimum tax. In addition, Levels II and III automatically compute self-employment taxes, and Level II computes income averaging.

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MULTIPLE PRINTING OPTIONS. You can input client tax information at the time of interview and produce forms immediately, or enter data during the day and batch print returns at night. MICRO-TAX* prints your returns on IRS forms, IRS approved substitute forms, or with transparent overlays.

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# People in the News: Michael Eisenberg

## Late blooming computer scientist and playwright brings the "Hackers" drama out of the basement and onto the stage

BY ROBIN RASKIN

NEW YORK—Hacker. Frob. Kludge. Twiddle. Tweak. No it's not a new programming language, it's the emerging English jargon, Computerese. HACKERS, once confined to midnight hours and huge university computer centers, are coming out from behind their terminals bringing their language and ideas with them. Easing their entrance into the "real" world is Michael Eisenberg, playwright, computer scientist, chemist and devoted hacker.

Eisenberg's off-Broadway production of *Hackers* (See "Play Is the Thing in Hacker Drama," *PC*, Volume 3 Number 8, page 57) is a glimpse at the lives of four computer science students. The play recently premiered at Manhattan's Punch Line Theatre.

"Hacking is a very compelling activity," says the animated young playwright. "The idea for a play about the hacker community had been brewing in my head for a long time. I admire hackers. They are brilliant people having fun."

When Eisenberg isn't sitting in Harvard Square scribbling lines for *Hacker*, he doubles as a second-year graduate student of computer science at the Massachusetts Institute of Technology (MIT).

"What especially intrigues me about computers is the reciprocal relationship between what you chose to do and your own personality. Naturally, peoples' personalities are reflected in their programs—there's a certain amount of narcissism in a computer programmer," reflects Eisenberg, who during this interview was monitoring an ongoing *Hackers* rehearsal.

### Pre-med Bypass

At age 27, Eisenberg is a relative latecomer to the hacking community. As a chemistry major at New York's Columbia University, Eisenberg toyed with but abandoned preparing for medical school. He recalls seeing a Barnard College Gilbert and Sullivan Society production that inspired him to try to write a play himself—So Eisenberg and a friend wrote a successful Varsity musical, Columbia's annual song and dance show.



After graduating from Columbia, Eisenberg worked as a chemist, writing plays in his spare time. He wrote the music and lyrics for a musical loosely based on Karel Capek's *R.U.R.* (Rossum's Universal Robots), the story of one inventor's spectacular robot gone awry.

Working nine to five didn't allow enough writing time, so Eisenberg opted for the world of computers. A part-time job at Rockefeller University in New York gave him his first real, hands-on computer experience. The job required him to maintain a large program written in assembly language, giving him time to write another musical. He also fell in love—with programming.

### Gaming Luck

Something of a programming addict, Mike secured a job as a programmer for Children's Computer Workshop the computer-age offspring of the Children's Television Workshop, purveyors of the Sesame Street culture. He designed a game called *Taxi* for the TRS-80. The game allows the player to operate a little taxi cab and drive around "maps" of a number of different cities. Passengers appear at random, and the player/driver is required to drop them off and pick them up while avoiding traffic tickets—all in "the most efficient" manner.

Eisenberg's analysis of his own situation led him to conclude that a return to academia and total immersion in computers would keep him computing and writing to his hearts content. In what he calls a long shot, he applied to MIT graduate school in computer science. Today he is joyfully bogged down with courses like Computer Architecture and Children's Language Acquisition.

Eisenberg gets excited as the conversation turns to his latest studies, artificial intelligence and the more "political" nature of computing power. "I like the fact that kids 'do' computers well, better than adults. It's a good experience for kids to feel they are in command of something and it's good for adults to be humbled. Who knows, maybe computer kids will be more distrustful of authority, even if they are a little weird in other ways?"

In *Hackers*, each of the play's junk foods-consuming, bleary-eyed characters work relentlessly to adapt the computer to man's nature or vice versa. One character is inventing an adventure game based on the story of his life; one is creating a computerized chess program that will outsmart the shrewdest human. One is an aspiring groupie who still thinks LISP is a speech impediment but realizes he's surrounded by something magical.

And then there's Martin, King of the Hackers. Hero Martin (if there is a hero) is trying to capture his own endearing soul in the computer's LISP machine. His ultimate dream is that he and his computer will be indistinguishable to a panel of the most scrutinizing experts. Through Martin's zany, brilliant, and incessant dialogue, Eisenberg pinpoints many of the problems and prospects of artificial intelligence.

Hours before he tests his "program to end all programs," Martin asks his basement-dwelling fellow hacker K.J.:

Martin: *"What if this program works? What if I go in there tomorrow and you can't tell the difference between me and a machine?"*

K.J.: *You'll have succeeded. It means you're the greatest hacker in the world.*

Martin: *But a total failure as human being.*

K.J.: *Same thing.*

Writing the play was a fusion of traditional and high technology. The first draft was written with pen and paper in Boston. Eisenberg wrote the final draft with MIT's EMACS, a powerful text editing system, and printed it with a laser printer. He sold *Hackers* to the Punch Line Theatre for $350 and receives a percentage from box office sales.

So what does he think as he watches the computing subculture becoming entertainment on stage? "I love it! I think it's great that the engineering type has become a media personality. It's a very complicated role model."

And the final question, can a computer write a play like *Hackers*?

Offers Eisenberg with his vaguely noncommital but constantly amused tone, "I don't think it'll happen in anything like the near future, but in principle it's not impossible". ■

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## Word Processing System for the IBM Personal Computer

It's obvious what makes her so cheap, but what makes Bonnie Blue so beautiful? Bonnie Blue is a new and easy-to-use word processing program for the IBM Personal Computer.

**The Full System.** The Bonnie Blue System includes in one program a full screen Editor, a Printing module and a useful Toolbox. It includes the features you've come to expect, and more:

complete cursor control: by character, word, line; page up and down instantly; go to top, bottom of document; auto scroll towards top or bottom
word wrap
margin justification, centering
adjustable margins, tabs, indents
reformat paragraphs
move, copy, delete, paste blocks
find with delete, insert, replace and wild card characters
keyboard remapping
multi-line headers, footers

Bonnie Blue can handle lines longer than the screen is wide, by horizontally scrolling the line. And, unlike some programs, Bonnie Blue lets you include any displayable character in your text, such as block graphics and foreign language characters.

**Unique Features.** With Bonnie Blue, you can "paint" display attributes onto your text, by the character, word, or line, or automatically as you enter text. With the monochrome adapter, you can paint any combination of underlined, bold, reverse video or blinking. With an 80 column monitor and the color/graphics adapter, this translates into a palette of 16 color combinations to choose from. And if your computer has both monitors, Bonnie Blue lets you use them both, shifting back and forth as you wish.

Bonnie Blue runs on IBM Compatibles such as Compaq, Columbia, etc. Printers supported include Epson RX, FX Series, Qume, Okidata and more.

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**Powerful Printing Module.** You can use these colors or display attributes to highlight text on the screen, and Bonnie Blue can remove them from a file when you want (all files created by Bonnie Blue are DOS standard). The Printing module understands these text attributes, and you can map them into any single printer function or combination.

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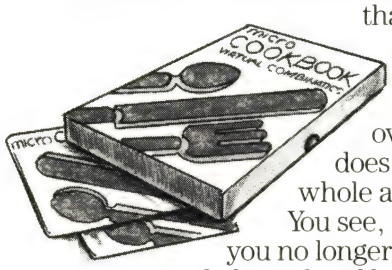
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PC 5/15/84

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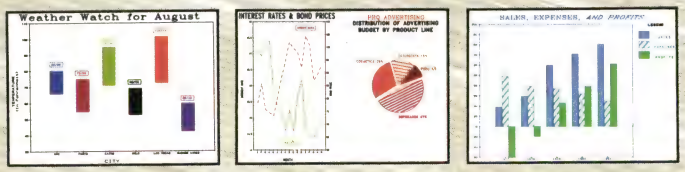
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| 300G | 133 |
| 310A | 175 |

### Dynax

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|---|---|
| 12" Green | 127 |
| 12" Amber | 138 |

### Taxan

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|---|---|
| RGB III | 446 |
| RGB 420 | 534 |

### PGS

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| PGS HX12 | 485 |
| MAX 12 | 196 |

### Sony

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|---|---|
| KX-1211HG-Profeel, the best | 725 |

### USI

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|---|---|
| Pi 2 12" Green | 125 |
| Pi 3 12" Amber | 142 |

### Sanyo

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| 8112 Hi/Res | 195 |

### NEC

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| JB 1201 | 162 |
| JB 1205A | 172 |
| JC 1410 | 817 |

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### Hayes

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| 300 | 207 |
| 1200 | 493 |
| 1200B | 432 |
| Micromodem IIe W/T | 242 |

### US Robotics

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| Autodial 212A | 460 |

### Novation

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| Access 1,2,3 | 473 |
| Apple Cat II | 277 |

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| Alphanumeric Display | 78 |
| Procom Software-Apple, IBM | 78 |

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| P212A | 415 |

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| Combo Plus 64K | 269 |
| Mega Plus | 269 |
| 64 K Ram Set | 55 |

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|---|---|
| RGB, Monichrome, Printer | 398 |

### Plantronics

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| Hercules Graphics Card | 370 |

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| MAI | 477 |

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| IBM | Printer Rom | 45 |
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| 2410 | | 2380 |

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| Delta 15 | 160 cps | 633 |

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| 7710 | 55 cps | 1963 |

### Brother

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| HRI | 16 cps | 569 |
| HR25 | 23 cps | 765 |

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| DX15 | 14 cps | 453 |
| Keyboard | | 149 |

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| Prism 80 color | 1419 |

### Transtar

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### Silver Reed

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| 500 | 431 |

### Juki

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|---|---|---|
| 6100 | 18 cps | 487 |

### Teletex

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### Mansman Tally

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| 160 | 160 cps | 641 |

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| Teac 55B ½ Height | 210 |
| Panasonic/Shugart ½ Height | 205 |
| CDC | 215 |

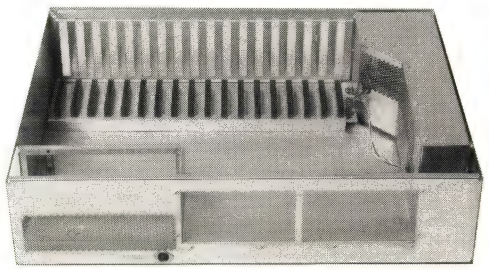
### For Apple

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|---|---|
| Super 5 ¼ Height | 203 |
| Quentin Ap 100-Y | 242 |
| Quentin Ap 105-Y ½ Height | 213 |
| Quentin Controller | 48 |
| Rana 1 | 255 |
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| Keytronics Keyboard DVORAK | | 169 |
| Keytronics Keyboard 5151 | | 255 |

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| Columbia 1600-1 | 2750 |
| TAVA PC | 1900 |
| Eagle I | 1650 |
| Eagle II | 2050 |
| Eagle III | 2270 |
| Eagle IV | 3500 |
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| Eagle 1620 | 3400 |
| Eagle 1630 | 5270 |
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| 925 | 717 |
| 950 | 914 |

### Wyse

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### Teletex

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| 3000 | 494 |

## SOFTWARE

### Ashton Tate

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| dBase II | 389 |
| Friday | 184 |

### Software Arts

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| TK Solver | 215 |
| Solver Pac | 88 |

### Seasoned Systems

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| Sure Stroke Dvorak Tutor | 48 |

### Sorcim

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| Super Calc III | 287 |

### Micro Pro

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| Mail Merge | 131 |
| Spellstar | 131 |
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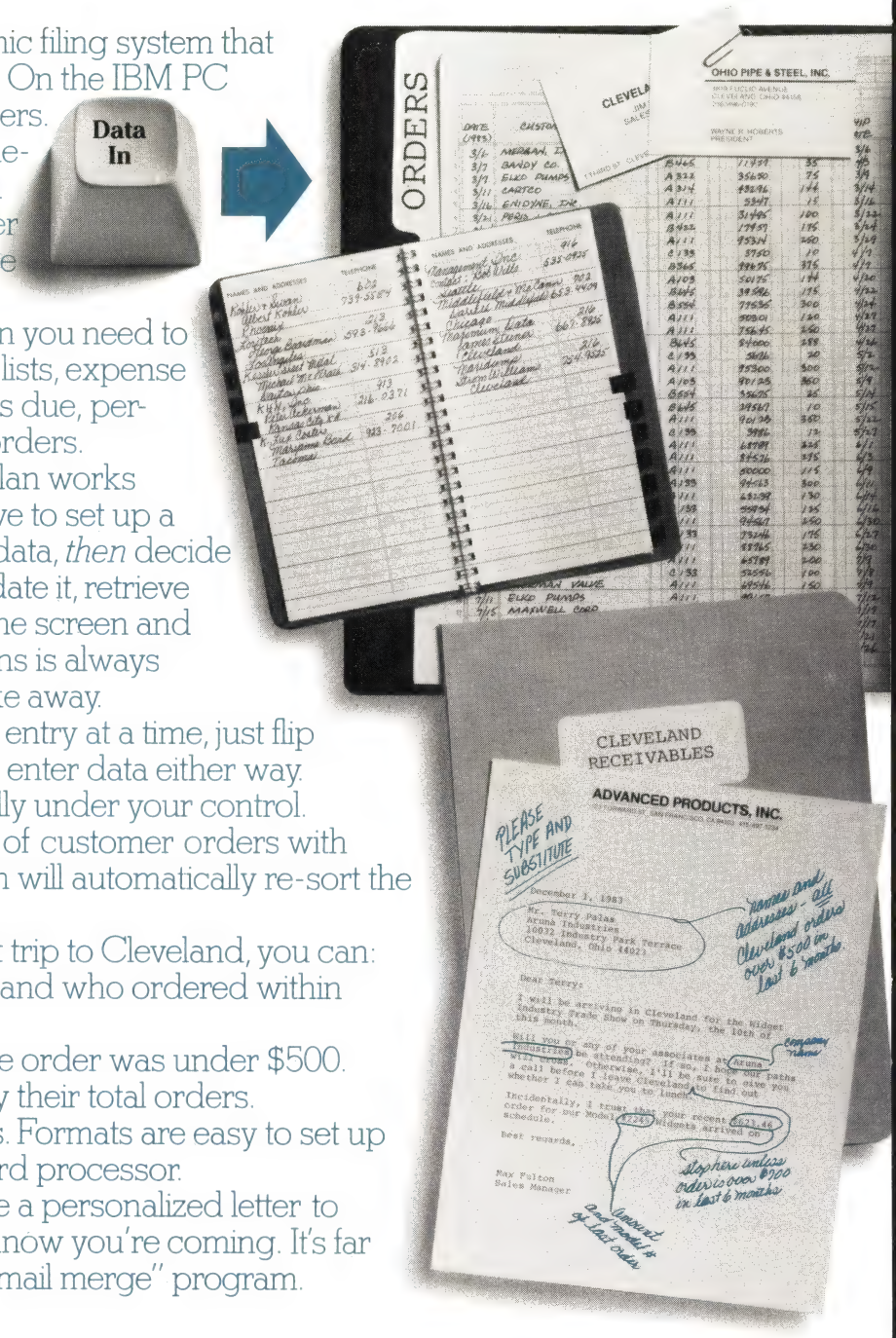
List everyone in Cleveland who ordered within the last six months.

Exclude anyone whose order was under $500.

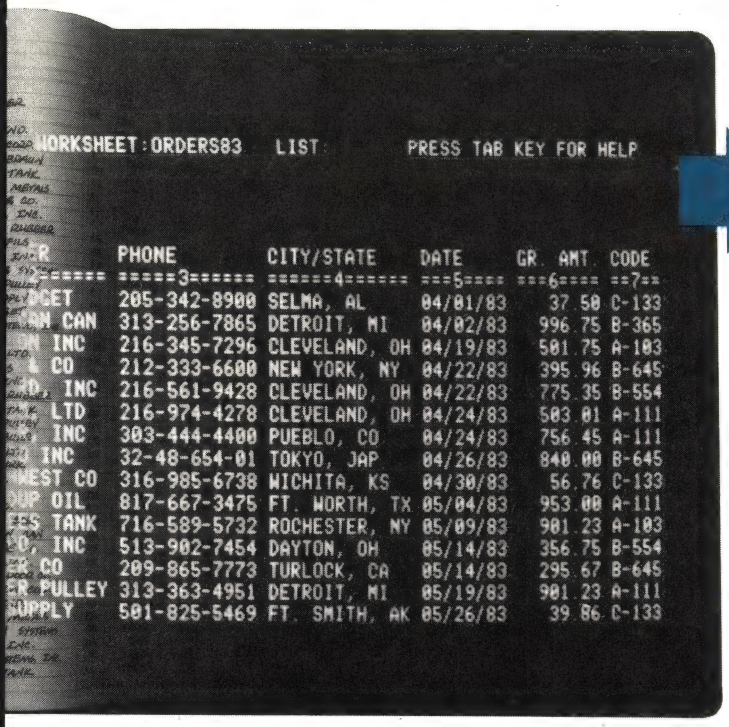
Rank the customers by their total orders.

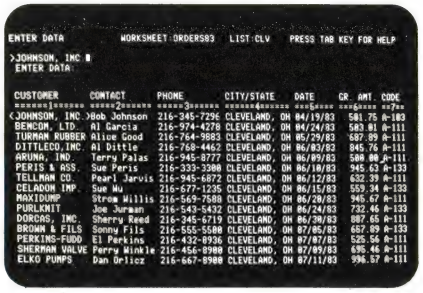
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# nizes your files like
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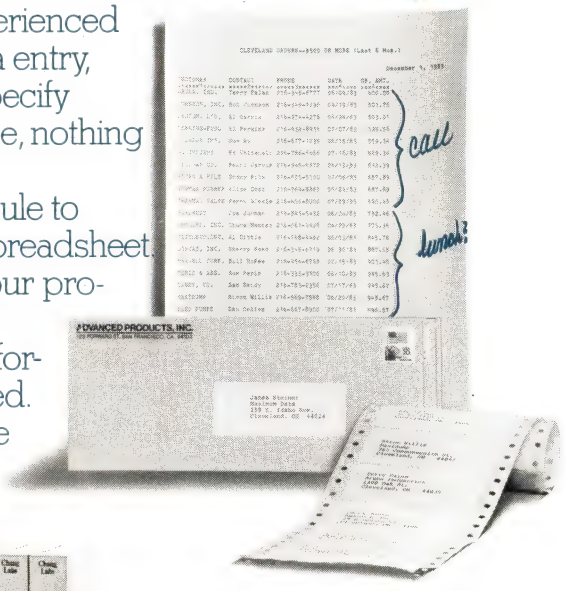
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| | Elite 2, 326K, 80 Track | $ 649 | $ 429 |
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| | Elite Controller | $ 145 | $ 89 |

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| ★ | **ComX**, 80 col. +64K RAM, for IIe, 1 Yr. Wty | | $ 199 | $ 99 |
| ★ | RAM Card, 1 Yr. Wty. (II+) | 16K | $ 179 | $ 39 |
| ★ | **Microsoft**, RAM Card (II+) | 16K | $ 100 | $ 69 |
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| | RAM Card (II+) | 64K | $ 425 | $ 299 |
| | RAM Card (II+) | 128K | $ 599 | $ 399 |



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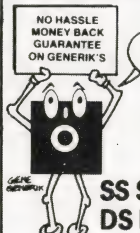
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| | Smart Cat 103/212 | $ 595 | $ 415 |
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| | Transend 1 for Apple II | $ 89 | $ 69 |
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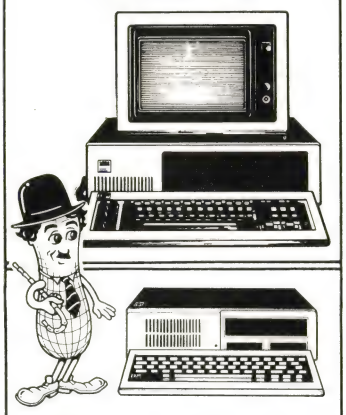
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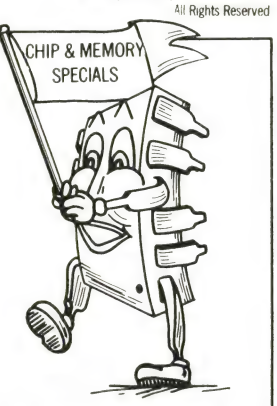


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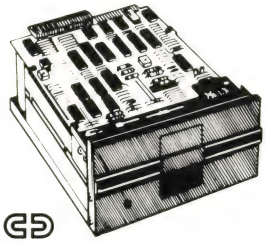
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| ★ **COMX,** Fastrak™, RAM/Disk emulator and printer spooler program. Works on any PC/DOS version or RAMCard. Menu Driven | | $ 100 | $ 59 |

### UTILITY & SYSTEM

| | LIST PRICE | OUR PRICE |
|---|---|---|
| **DIGITAL RESEARCH,** | | |
| Concurrent CP/M-86™ | $ 350 | $ 225 |
| Concurrent CP/M-86™ w/ windows | | Call |
| CP/M-86™ | $ 60 | $ 40 |
| CBASIC 86™ | $ 200 | $ 135 |
| CBASIC Compiler (86 or MSDOS), each | $ 600 | $ 365 |
| Pascal/MT+ (CP/M-86) | $ 400 | $ 269 |
| Pascal/MT+ (MSDOS) | $ 600 | $ 399 |
| PL/1 (MSDOS) or CP/M-86, each | $ 750 | $ 499 |
| Access Mngr.(MSDOS or CP/M-86), each | $ 400 | $ 179 |
| Display Mngr.(MSDOS or CP/M-86), each | $ 500 | $ 339 |
| Speed Prog. Pkg. (CP/M-86) | $ 200 | $ 135 |
| CIS COBOL-86 | $ 850 | $ 525 |
| DR LOGO-86 | $ 100 | $ 69 |
| **HAYES,** Smartcom II (Data Com.) | $ 119 | $ 89 |
| **INSOFT,** GraFORTH (animated 3D graph.) | $ 125 | $ 95 |
| **MICROSTUF,** Crosstalk XVI (Data Com.) | $ 195 | $ 129 |
| **MICROSOFT,** muMath/muSimp | $ 300 | $ 199 |
| Business BASIC Comp. | $ 600 | $ 399 |
| Pascal Compiler | $ 350 | $ 250 |
| C Compiler | $ 500 | $ 339 |
| BASIC Compiler | $ 395 | $ 269 |
| FORTRAN Compiler | $ 350 | $ 250 |
| COBOL Compiler | $ 750 | $ 495 |
| **NORTON,** Utilities 2.0, 14 programs | $ 80 | $ 65 |
| **ROSESOFT,** Prokey | $ 75 | $ 50 |

### HOME & EDUCATIONAL

| | | |
|---|---|---|
| **Atari,** Centipede, PacMan or Donkey K.,ea. | $ 35 | $ 28 |
| **Beagle Bros.,** Beagle Bag | $ 30 | $ 22 |
| **Bluechip,** Millionaire | $ 60 | $ 40 |
| **Broderbund,** Choplifter or Lode Runner, each | $ 35 | $ 25 |
| Arcade Machine | $ 60 | $ 40 |
| Apple Panic | $ 30 | $ 21 |
| **BudgeCo.,** Pinball Constr. Set | $ 40 | $ 27 |
| ★ **Continental,** Home Accountant | $ 75 | $ 49 |
| **Datasoft,** Aztec or Zaxxon, each | $ 40 | $ 27 |
| **Davidson,** Math Blaster! | $ 50 | $ 34 |
| **Edu-Ware,** (Large Inventory) | | Call |
| **Hayden,** Sargon II (Chess) | $ 35 | $ 29 |
| Sargon III (Chess) | $ 50 | $ 34 |
| **Infocom,** Zork I,II,III, or Starcross, each | $ 40 | $ 27 |
| **Koala,** Full line in stock, CALL | | Call |
| **Learning Co.,** (Large Inventory) | | Call |
| **Micro Lab,** Miner 2049er | $ 40 | $ 27 |
| **Microsoft,** Typing Tutor | $ 25 | $ 17 |
| **Monogram,** Dollars and Cents | $ 100 | $ 69 |
| **Origin,** Ultima III | $ 60 | $ 40 |
| **Scarborough/Lightning,** Mastertype | $ 40 | $ 27 |
| **Sierra/On-Line,** Ultima II | $ 60 | $ 40 |
| **Sir-Tech,** Wizardry | $ 50 | $ 39 |
| **Spinnaker,** Kindercomp (others in stock) | $ 30 | $ 20 |
| **Sub Logic,** Flight Simulator II | $ 50 | $ 37 |

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# Plain talk about printers

## Dot Matrix

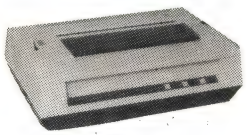
Printer compatibility with the IBM-PC marches on: the line-up includes the Microline 92/93, C. Itoh's Prowriter BPI, the Radix Series and NEC's 2050/3550.

### ANADEX

| | |
|---|---|
| 9500B | $1119.88 |
| 9501B | $1119.88 |
| 9620B | $1209.88 |
| 9625B | $1309.88 |
| WP-6000 | $2359.88 |
| WP-6500 | $2599.88 |
| WP-6000/6500 Tractor | $139.88 |

### C. ITOH

#### Prowriter 1 & 2
#### Prowriter BPI
#### Prowriter SP



C. Itoh's **Prowriter** (120 cps) features 10, 12, & 16 cpi, a proportional/correspondence quality font, double strike, double-width, sub/super scripts, dot graphics (160 x 144 dpi) & friction/tractor feed.

The **Prowriter BPI** offers code-compatibility with IBM-PC block/dot graphics codes, & it has all the features of the Prowriter. A nice move.

The **Prowriter SP** (HotDot) has faster print speed (180 cps), true sub/superscripts and italics. A new printer with nice features.

| | |
|---|---|
| Prowriter | $379.88 |
| Prowriter 2 | $609.88 |
| Prowriter BPI | $479.88 |
| Prowriter SP | $519.88 |

### EPSON



| | |
|---|---|
| RX/FX Series | $CALL |

### IDS/DATAPRODUCTS

| | |
|---|---|
| P-480 | $439.88 |
| Prism 132 | $1489.88 |
| w/4-color | $1699.88 |

### INFORUNNER

| | |
|---|---|
| Riteman | $339.88 |

### MEMOTECH

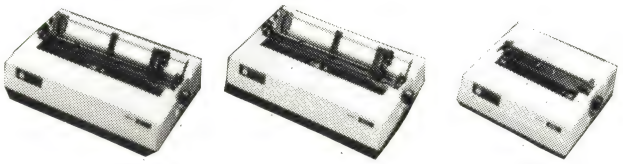
#### DMX-80

A dramatic black printer! The **DMX-80** (80 cps) features 10, 12 & 16 cpi, italics, double-width, half-width, enhanced/bold print, dot graphics (120 x 144 dpi), friction/tractor feed. Comes with a 4,000,000 character ribbon. Epson code compatible in text mode (questionable in graphics). Quiet printing & a sharp design make it ideal for home or office. The **DMX-80** is serviced by Panasonic.

| | |
|---|---|
| DMX-80 | $339.88 |

### OKIDATA

## Microline Family



The Okidata ***Microline*** family offers IBM-PC users a wide range of features for almost any application. All ***Microline*** printers are made with the same rugged materials and care. No matter which printer you select, you've chosen one of the best printers made.

The **Microline 92** (160 cps) is ideal for word processing. It features 10, 12 & 17 cpi, a correspondence font, double-width, emphasis/boldface, sub/super scripts, underlining, pin/friction feed (tractor is optional on the **92**) & dot-addressable graphics (120 x 144 dpi). The **93** is the 136 column version. Parallel interfaces are standard; the RS-232C interface is optional.

The **Microline 84** (132 col) is the Step 2 version, featuring 200 cps at 10, 12, & 17 cpi (w/double-width), all with a correspondence mode & dot addressable graphics. Parallel or RS-232C interfaces available.

A new PROM called **PC Plug-n-Play** turns a **92, 93** or an **84** into an IBM-PC compatible printer, with full capabilities. You will sacrafice a few features (like 12 cpi) but the PROMs are worth it if total compatibility is your goal.

The **Microline 82A** (120 cps) is a data cruncher. Features 10 & 16 cpi (5/8 double-width). Dot-addressable graphics are optional. The **83A** is the 136 column version.

| | |
|---|---|
| Microline Series | $CALL |

### MANNESMANN TALLY

| | |
|---|---|
| MT-160 L | $629.88 |
| MT-180 L | $879.88 |
| MT-Spirit | $329.88 |

### QUADRAM

| | |
|---|---|
| QuadJet | $CALL |

### STAR MICRONICS

| | |
|---|---|
| Gemini 10X | $299.88 |
| Gemini 15X | $429.88 |
| Delta 10 | $499.88 |
| Delta 15 | $589.88 |
| Radix 10 | $629.88 |
| Radix 15 | $739.88 |

### TOSHIBA

| | |
|---|---|
| P-1350 | $1739.88 |
| P-1350 Tractor | $169.88 |

## Letter Quality

### C. ITOH

#### A10 Starwriter
#### F10 Starwriter
#### F10 Printmaster



The C. Itoh **Starwriter** (40 cps) features 10 & 12 cpi, sub/super scripts, underlining, 6 & 8 lpi, Qume code & Diablo supplies. The **A-10 Starwriter** has the same specs, but it's slower (20 cps). The **Printmaster** has the same specs, but it prints faster (55 cps).

Both the **Tractor Feed** & the **Sheet Feeder** fit all three models.

| | |
|---|---|
| A-10 Starwriter | $599.88 |
| F-10 Starwriter | $1119.88 |
| F-10 Printmaster | $1469.88 |
| Tractor Feed | $219.88 |
| Single Bin Sheet Feeder (A10/F10) | $599.88 |

### COMREX

| | |
|---|---|
| CR-2 | $509.88 |
| CR-2 Tractor | $89.88 |
| CR-2 Sheet Feed | $189.88 |
| CR-2 Keyboard | $149.88 |

### DIABLO

| | |
|---|---|
| 620 (RS-232C) | $939.88 |
| 630 (PC) | $2019.88 |
| 630 ECS (PC) | $2359.88 |

### DTC

| | |
|---|---|
| DTC 380Z | $1199.88 |
| Tractor Feed | $149.88 |
| Sheet Feed | $599.88 |
| StyleWriter | $759.88 |
| Tractor Feed | $129.88 |
| Sheet Feed | $279.88 |

### NEC

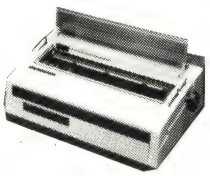
| | |
|---|---|
| 2010/2030 | $899.88 |
| 2050 | $1039.88 |
| 3530 | $1699.88 |
| 3550 | $1859.88 |
| 2000/3500 Tractor | $239.88 |
| 2000/3500 Sheet Feed | $479.88 |
| 7710/7730 | $2199.88 |
| 7700 Tractor | $379.88 |
| 7700 Sheet Feed | $599.88 |

### QUME

| | |
|---|---|
| Sprint 11/40 | $1559.88 |
| Sprint 11/55 | $1769.88 |
| Tractor Feed | $219.88 |
| Sheet Feed | $599.88 |
| LetterPro (20cps) | $709.88 |

### SILVER REED

#### EXP-550/500



The Silver Reed **EXP-550** (17 cps) is a 132 column letter-quality printer with 10, 12 or 15 pitch, sub/superscript, underlining & ***true*** Diablo 1610 emulation, making it compatible with most word processing software. It's friction fed, & it features a page injector; an optional tractor is also available.

The **EXP-500** (12 cps) is a 100 column letter-quality printer with the same specs as the **EXP-550**, but slower & without page inject or proportional spacing.

| | |
|---|---|
| EXP-550 (Parallel) | $609.88 |
| EXP-550 Tractor | $129.88 |
| EXP-500 (Parallel) | $449.88 |
| EXP-500 Tractor | $119.88 |

### SMITH-CORONA

#### Messenger

The **Memory Correct III Messenger** combines an electric typewriter ***and*** a letter-quality printer. It features 12 cps, 3 pitches (10, 12 & 15), variable line spacing, 10.5" writing line, backspacing & auto-correction. It comes complete with parallel/serial interface.

| | |
|---|---|
| Messenger | $589.88 |

### STAR MICRONICS

#### PowerType

The **PowerType** (17 cps) has 110 columns (11" print line), 10, 12 & 15 cpi, proportional type, sub/superscripting, backspace/underlining & Diablo 620/630 code compatibility. A nice printer for the price.

| | |
|---|---|
| PowerType | $359.88 |

## Accessories

### Printer Stands

Heavy-guage steel with a baked enamel finish (beige), with a paper slot in the center for bottom feeding. Fits 80 or 132 column printers (specify).

| | |
|---|---|
| 80 Column Stand | $39.88 |
| 132 Column Stand | $49.88 |

### Microfazer

Parallel in/Parallel out printer buffers in 8K to 512K, configurations. These are stand-alone units with pause and copy/clear buttons. User expanable. Power supply included, but the cables are optional.

| | |
|---|---|
| 8K P/P | $129.88 |
| 64K P/P | $169.88 |
| 128K P/P | $239.88 |
| 256K P/P | $549.88 |
| 512K P/P | $769.88 |
| Male-male cable | $29.88 |

### Cables

Printer cables for the IBM-PC, IBM-PC/IDS, Compaq, Columbia MPC & VP, Eagle-PC/Spirit and many others, as well as 9-wire modem cables. All cables | $29.88

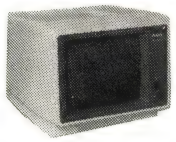
### Printer Switches

2-way & 4-way switches for 36-pin Centronics or 25-pin RS-232C. All connectors are female, & cables are extra.

| | |
|---|---|
| 2-Way Switch Box | $109.88 |
| 4-Way Switch Box | $CALL |

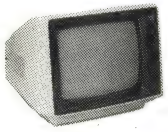
## Monitors

### AMDEK



300G (12" green) ..... $149.88
300A (12" amber) ..... $159.88
310A (12" amber) ..... $199.88

### NEC



JB-1205M (12" amber) ..... $169.88
JB-1201M (12" green) ..... $169.88

### PRINCETON GRAPHICS



PGS HX-12 ..... $509.88
PGS Max-12 ..... $199.88

### QUADRAM

QuadChrome ..... $519.88

### ROLAND

DG-121 Composite
(12" green or amber) ..... $159.88
DG-122 TTL (IBM-Monochrome)
(12" green or amber) ..... $179.88

## Modems

### HAYES

***Smartmodems***
300 baud ..... $239.88
300/1200 baud ..... $559.88
1200B w/SmartCom II ..... $489.88

### NOVATION

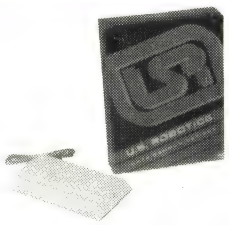
***SmartCat Modems***
300 baud ..... $189.88
1200 baud ..... $439.88
***Access 1-2-3***
IBM-PC internal board
modem w/Crosstalk ..... $449.88

### US ROBOTICS

***PC Modem***
***PC Modem 64/PC Modem 256***
**PC Modems** are plug-in modem boards that have all the features of the Password.
The **PC Modem 64/256** are also modem boards that also come with 64 or 256K RAM, a parallel port & real-time clock with a battery back-up.
Password
1200 baud ..... $369.88
300 baud ..... $159.88
PC Modem ..... $CALL
PC Modem 64K ..... $579.88
PC Modem 256K ..... $779.88
Telpac ..... $69.88

### US ROBOTICS

## Password



Big features in a tiny package. The USR **Password** operates at 0-300 or 1200 baud, in either originate or answer modes, with auto-dial, auto-answer, full or half duplex operations, command echo, audio monitor with three modes of operation, verbose or numeric result codes and both DTR override and reversible Send/Transmit data (pins 2 and 3). Comes complete with RS-232 cable, modular cable and power supply. Works with CrossTalk, PC-Talk, SmartCom II, Perfect Link, etc., or with USR's own **Telpac** communications software. Specify type of computer when you order.
USR Password ..... $369.88
Telpac (IBM-PC) ..... $69.88

## Peripherals

### ALLOY

***52 MB Disk/Tape System***
Complete hard disk/tape sub-system ..... $CALL
***PC Backup***
Stand-alone 4-track Tape Backup System ..... $CALL

### AST RESEARCH

***MegaPlus II***
Comes with an RS-232C port, clock & memory to 256K. Software included.
64K MegaPlus ..... $319.88
256K MegaPlus ..... $519.88
256K MegaPak ..... $339.88
Parallel Port ..... $39.88
Optional #2 RS-232C Port ..... $39.88
Game Port ..... $39.88

***SixPak Plus***
The **Sixpak** has an RS-232C port, a parallel port, clock & memory to 384K. Software included. An optional game port is also available.
64K Sixpak ..... $319.88
256K SixPak ..... $519.88
384K SixPak ..... $639.88
Game Port ..... $39.88

### HERCULES

Graphics Master ..... $379.88

### MA STSTEMS

ColorPlus ..... $439.88
I/O Processor ..... $349.88

### MICROSOFT

Mouse (mechanical) ..... $149.88

### MOUSE SYSTEMS

***PC Mouse***
An optical mouse with "pop-up" menus for Lotus 1-2-3, Multiplan, VisiCalc, Volkswriter, WordStar, etc. Superior performance. Comes with optical pad, mouse unit, power supply & software ..... $479.88

### PARADISE/USI

***MultiDisplay***
Supports 600 x 200 monochrome (TTL) 320 x 200 RGB and composite video output. Plugs for all three types of monitors. Also includes a parallel port. A perfect, one-slot substitute.
MultiDisplay ..... $479.88

### QUADRAM

***Quadboards***



The **Quadboard** has an RS-232C port, a parallel port, a clock & memory to 384K (you can also get your **Quad board** "naked," with no memory installed). QuadSpool/Drive software is included with every **Quadboard**, along with a one-year warranty.
Quadboard ..... $CALL

***Quad 512 +***
**Quad 512+**s have a single RS-232C port on them, & socket for up to 512K RAM. QuadSpool/Drive software is included.
Quad 512+ (64K) ..... $239.88
Quad 512+ (256K) ..... $CALL
Quad 512+ (512K) ..... $CALL

***Quad Memory***
**The Quad Memory** boards have no I/O ports on them, but they are socketed to 192K.
Quad Memory(64K) ..... $209.88
Quad Memory(128K) ..... $279.88
Quad Memory(192K) ..... $339.88

***Quadram Video Boards***
The **QuadColor-1** has 320 x 200 RGB, but with **QuadColor 2** you get 690 x 480, 132 colors, much more besides. Exceptional!
QuadColor-1 ..... $219.88
QuadColor-2 ..... $229.88

***QuadDisk***
An internal fixed hard disk, with interface board, software & cable.
12MB ..... $CALL
20MB ..... $CALL

***Quad I/O***
**Quad I/O** have a parallel port, an RS-232C port, game port & clock. Software included. An optional second RS-232C port is also available.
Quad I/O ..... $CALL

***Single Function Cards***
Parallel Card ..... $79.88
RS-232C Card ..... $79.88
Clock/Calendar Card ..... $79.88

***QuadLink***
**QuadLink** is like having an Apple computer on one board, with 64K. **QuadLink** takes up only one slot. Add $20 for Columbia MPC or Compaq computers when you order.
QuadLink ..... $499.88

### QCS

***External Hard Disk***
The ***QCS Hard Disk*** comes with an interface board & cables. Our personal favorite, used in-house for our mail list.
12MB ..... $2179.88
20MB ..... $2439.88
26MB ..... $2629.88

### TANDON

TM 100-2 Double-sided ..... $229.88

### TITAN

***Cygnus***
An I/O board that fits in the XT short slot (or on a standard PC slot). Includes a game port & real-time clock with battery back-up. Comes in either a parallel or RS-232 version.
I/O (Par.) ..... $149.88
Cygnus I/O (RS-232) ..... $169.88
***Titan Board***
A unique board socketed for up to 576K RAM. Includes a parallel port, RS-232C port, clock, software (Psuedo Drive/Spooler, Clock & Hard Disk), plus a SASI adapter for a hard disk interface.
w/64K ..... $559.88
w/576K ..... $1069.88

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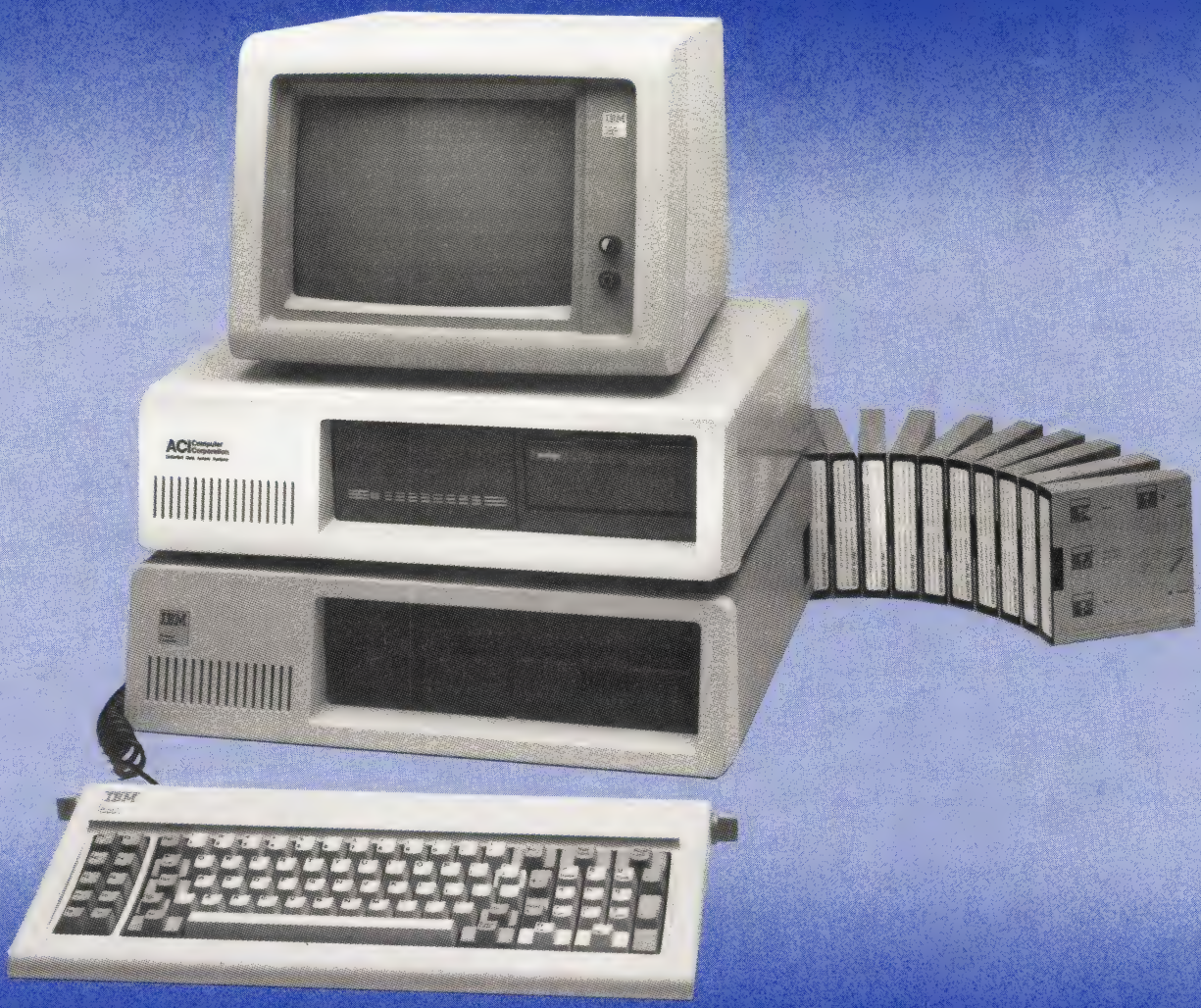
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Vice President, Product Development
Advanced Ideas

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Advanced Ideas (formerly Computer-Advanced Ideas) leads the industry with programs designed for extendability through easy-to-use authoring systems and a unique library of LearningWare™ diskettes. Rich game play and sound educational design have won Advanced Ideas programs the approval of the National Education Association.

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# A Visit to the New Orleans Fête

PC's editors traveled south to charming New Orleans for the first Softcon. We found this show more pleasant than COMDEX, but the Superdome left something to be desired.

New Orleans. There's no place quite like it—a confluence of disparate languages, traditions, people, and buildings. The soft inflections of the residents are totally different from the usual drawl of the Deep South. Instead, their speech patterns have a stately, measured quality to them, sort of like Bostonians on barbiturates.

New Orleans has much to offer the tourist, historian, and convention goer. Its Superdome is one of the dominant features of an otherwise planar landscape, and this is where the first Softcon was held.

In the structure, which looks like a pregnant cooling tower, gathered 560 vendors and more than 20,000 visitors. Twenty thousand visitors? Less than a single day's COMDEX turnout? What kind of show was it?

It was a fine show, let me tell you. For a visiting journalist, it was a delight—room to roam, time to talk, available vendors. The wide aisles were most crowded near the Apple and Lotus booths, with IBM's area only a little less jammed. The attractions? Macintosh. Symphony. The PC Portable.

Of course, there were other attractions, including the journeyman database products such as *Power-base* and *Salvo*. And Leading Edge's new *Nutshell* database manager, on display for the first time, caused quite a stir.

"Macintosh Development Team" posters were everywhere. If Apple didn't have the most vendors supporting its Macintosh, we have no doubt that it was in second place.



**Bill Machrone**

We thought we knew about every database product available for the PC, but, to our amazement, we found ten more at the show. More grist for our editorial mill.

Many of the vendors we talked with were nervous about the small crowds. Some said that the attendees they were seeing were from large companies that are already their customers. Others claimed that the leads they were getting, especially on prospective dealers, were better than those from COMDEX.

The vendors were unanimous, however, about the high quality of the attendees. Most were business professionals, a fact that was clear from their attire. One exhibitor, accustomed to attending UNIX-oriented shows, couldn't believe that tennis shoes and T-shirts were entirely absent.

## Not-So-Superdome

As a place to hold a software show, the Superdome itself got mixed reviews from attendees. The main floor had wide, spacious aisles, and the stands were a welcome place to sit and review handouts, have a discussion, or simply catch your breath. The "plaza level" and loge level, on the other hand, had serious shortcomings. On the plaza level, the booths were arrayed in an unending circle around the dome, with gaps of unsold space separating clusters of exhibitors. The floor was glazed quarry tile, which, inexplicably, had been waxed, giving it about as much traction as a banana peel. Sometimes the fastest way to get to an exhibit was to go down to the main show floor, across, and up again.

The loge level was far worse. In addition to the exhibits ringing the floor, rooms full of exhibitors were tucked away in odd places. Some of these rooms bustled with active, attractive exhibits, but others were moribund.

Getting to these rooms wasn't easy, either. The floors were marked with trails

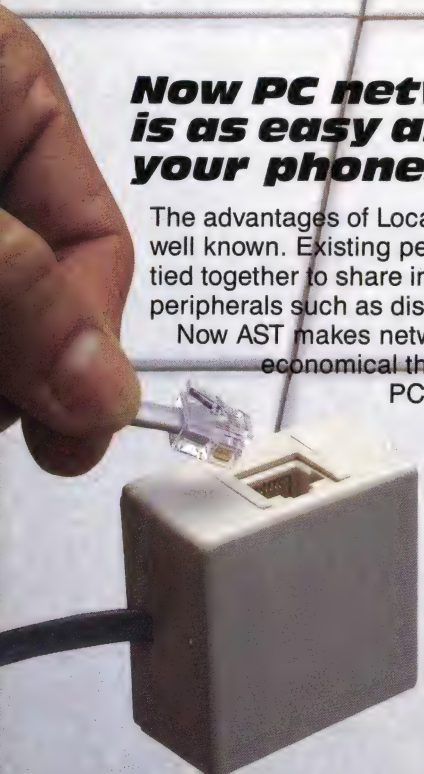
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of colored tape, and theoretically, you could follow the proper color to the room you wanted to see. The problem was, the tapes as often as not meandered down wide, sweeping passages that took you back to the plaza level. These passages became a joke during the opening day of the show. Guards were posted at the entrance to the plaza level, advising everyone to take the escalator up to the loge level. There they were greeted by a bullhorn-wielding guard who directed them to one of the passage ramps, which took them back to the plaza level and the first set of guards.

Tiring of this exercise, some attendees stormed the plaza level gates. The guards did their best to hold fast, but ultimately they were overwhelmed by the crush of exhibitors and visitors who wanted to get to the booths. Not that they should have wanted to be inside: the air conditioning was running full tilt on a not-too-warm day, and the public address system was rupturing everyone's eardrums. The organizers managed to get the air conditioning turned off by mid-afternoon, but the showgoers' elation was short-lived as a public address system announcement to that effect made everyone wince and cover their ears.

The Ziff-Davis booth was never dull and became a meeting place for the industry.

One place that was never dull was the Ziff-Davis booth. It became a meeting place for the industry, as a stream of software developers, entrepreneurs, authors, pundits, readers, and executives came by and stayed for conversation. That they had time to do so was swell for us, but perhaps it was not so swell for other exhibitors.

Journalists abounded at the show, all hot on the trail of the newest and best that the manufacturers had to offer. In fact, the computer journalism field has grown to the point where there is even a magazine about it, called *Computer Magazine Retailing*.

## Bottoms Up

New Orleans is one of the few places in the country where public drunkenness is not only acceptable but commonplace. A group of us came back to our hotel one night to find a pair of show attendees, drinks in hand, swaying lightly, utterly confounded by the revolving door at the entrance.

The city has its drunken habitues, as well as its drunken visitors. Two young women from one of the public relations firms brought their jogging gear, eager for a temperate respite from the frozen tundra of their home city. As they paced off the miles, they were pursued, mostly in inebriated imitation, by a number of the denizens of the street. A quicker pace and a little kick to the stride was all it took to outdistance these pursuers.

Meanwhile, at some of the nicer restaurants, lines had formed outside. Prospective patrons held one another's place in line while they ran a door or two away to get drinks to go from the gin mills. The lines turned positively convivial at that point—kind of like an open-air party.

One of our editors, finally obtaining a table, was informed by his waitress, "Most of you computer people are nervous and not very nice, but I like you."

Lotus Development Corporation threw what could only be called a "Mixed Metaphor" party: It featured a soul band in a Cajun swamp where guests were served Irish whiskey. Timothy Leary was there and, seemingly, at every other party and open house. Perhaps he'd finally transcended any of the more annoying natural laws—the inability to be in more than one place at one time.

Meanwhile, out on the taxi line (nowhere near as bad as that at COMDEX in Las Vegas), I was regaled with New York jokes: "How many New Yorkers does it take to change a light bulb? None of your damn business." And here I had been wondering whether the trip would be worth it.

* * *

Back in our January 24 issue, I promised you some articles the likes of which have never been seen in a consumer publication. One of these articles is coming up in our June 12 (Volume 3 Number 11) issue. We call it "Project: Database" and it's now into production.

We will be running a series of reviews of *every* database product available for the PC. Each product is assigned to one of four categories based on its capabilities. Using standard data, each category of program has a standard set of tasks to perform. The tasks increase in difficulty from one category to the next and are related in their nature and focus. Each product also gets a comprehensive review, which covers ease of use, and standard reports. Screen photos are also included.

Project: Database will cover 100 or more products, reviewed by nearly 20 authors. Some of these authors' names will be familiar to you, while others will be new to the pages of this magazine. But all are expert and eager to share their findings with you.

Naturally, we wouldn't be able to tell you as much as we'd like about every product and put it all in one issue, so the reviews will be spread over five or more consecutive issues. The result will be the definitive report on database management for the PC. Comprehensive charts will allow you to compare products quickly and easily, while the descriptive portion of the review will tell you what it's like behind the wheel of each product.

Another pacesetting series already in the works is our ongoing Price Waterhouse Report on financial and accounting software. More open-ended than Project: Database, in this series professionals from the Big 8 accounting firm give detailed, hands-on reviews of accounting packages. ■

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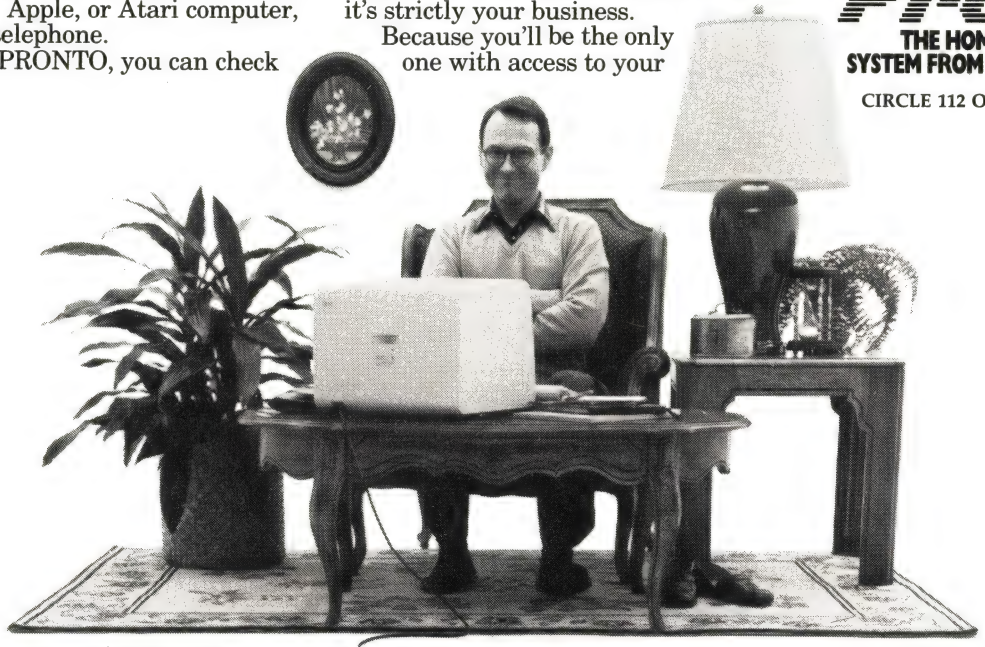
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# An Adolescent In Disguise

## The microcomputer software industry is reaching a critical stage in its development but, appearances to the contrary, it still has a long way to go before reaching maturity.

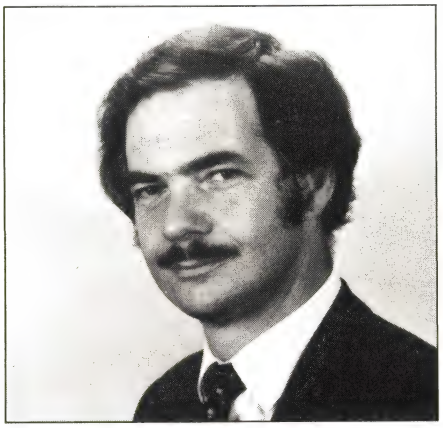
In the microcomputer software business, looks can be deceiving. For example, companies like Microsoft, Digital Research, VisiCorp, Software Arts, and Lotus Development Corporation have achieved the status of giants. Take a quick look at their achievements and you might think they were part of a mature and well-established industry.

But look again. The numbers reveal how young the business really is.

The press has been understating the number of microcomputers that IBM is currently shipping. In fact, IBM is building and shipping more than 10,000 personal computers per day. It expects to sell three million in 1984. On the other hand, Lotus has been shipping between 7,000 and 12,000 packages of *1-2-3* per month. Does this represent success? Certainly the company is doing well, but its monthly sales are unimpressive given the size of the customer base that it is addressing and the fact that *1-2-3* is one of the best-selling packages around.

*VisiCalc* is still *the* largest-selling program. In 1983, VisiCorp sold approximately 400,000 packages for the PC, Apple, Radio Shack, Hewlett-Packard, and CP/M markets combined. Impressive? Yes, considering the age of the program and the absolute number of copies sold. No, considering the size of the program's potential market.

If you look at the entrenched leaders of the microcomputer software industry, you can be excused for assuming that the industry is reaching maturity. But even these leaders are achieving relatively limited market penetration, and when you consider how little product and distribution innovation we've seen, the potential and the need for change comes into focus.



**Adam Osborne**

One obvious area in which change is overdue is pricing. The average personal productivity software package costs $500 and consists of a thin, badly written, badly reproduced sheaf of documentation and a floppy disk: approximately $7 worth of goods. Stick the documentation into a three-ring binder, package the whole thing in an expensive box, and you can drive the cost up to $30 or $40. But the three-ring binder does not make the meager and badly written manual any easier to read, nor does the fancy box make the program any easier to run. No industry can get away for long with a $500 price tag on a product that costs $7 to produce.

Service and support are often mentioned as justifications for the high price of microcomputer software, but this argument does not stand up to closer scrutiny. In the first place, most computer stores simply do not have the staff to properly support the software packages they sell, nor can they afford to enlarge their staffs to provide better service. The store's profit margin is too small to accommodate free software support. If software sales are to remain profitable, computer stores will have to charge for any support they provide. The myth that support justifies high prices is only that: a myth.

Something has to give. Dramatic changes in the microcomputer software industry are necessary and inevitable. The industry is barely off the ground, and 1984 should be a very interesting year. ■

*Adam Osborne founded the Osborne Computer Corporation, which introduced the first portable computer. His newest company, Software Seed Capital Corporation, represents the second stage of the microcomputer revolution.*

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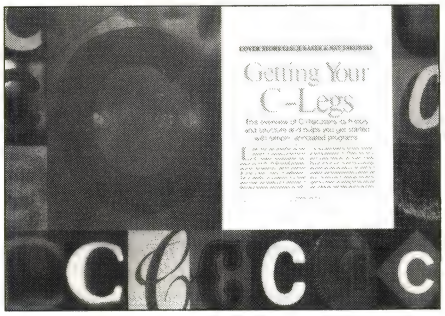
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**CIRCLE 160 ON READER SERVICE CARD**

# Letters to PC

## C Language for All

I am writing to register a mild complaint about some aspects of the articles on the C language in your March 20 issue (*PC*, Volume 3 Number 5). My complaint is essentially that they simultaneously suffer




from being too technical for the novice and too superficial for the expert. Let me give a few examples.

In the first article, "Getting Your C-Legs," Leslie Baker and Nat Sakowski make a point of allowing for different text editors and then say that the way to compile a program is to put the program diskette in drive A and key in "B:LC1 name.C", etc. They don't mention that the commands for compilation will vary from compiler to compiler and that their example is for the Lattice compiler. This is needlessly confusing to readers who are new to C (or to compiler languages in general) and needlessly annoying to those who are used to other compilers.

Similarly, Baker and Sakowski's review of version 2.0 of the Lattice compiler is not as helpful as it could be ("New Improved Lattice C"). They carefully explain the trade-offs involved in using the different memory models, but they don't give any quantitative information about how much slower the large model is. They don't describe the quality of the documentation, and they raise questions, which they fail to answer, about the compatibility of the Lattice compiler with the Kernighan and Richie standard.

It is my understanding that the program in Figure 1 is acceptable, if not very clean, and that any compiler compatible with the standard should handle it—even the earlier versions of the Lattice compiler, contrary to what the article suggests. Thus Baker and Sakowski raise (but don't answer) questions about the technical aspects of the compiler, and at the same time don't discuss some of the things most basic to a review.

Mark Zachmann's reviews of the Mark Williams and Whitesmiths compilers are much more helpful ("The Whitesmiths C Native Compiler" and "The MWC-86 C Compiler"). Zachmann addresses compatibility, ease of use, and performance. But why does he feel the need to write a new set of benchmark programs? At least he gives us the results for Lattice C so we can compare the newer products with a known quantity (though he doesn't say which version of Lattice he's using). It would be even more helpful if he had run a wider range of benchmarks. For example, none of his programs does much I/O.

I think that it's important for *PC* to provide both introductory surveys and fairly technical product reviews. I know that it's extremely difficult for a single article to address the entire audience of PC users;

> It's difficult for one article to address the entire PC audience.

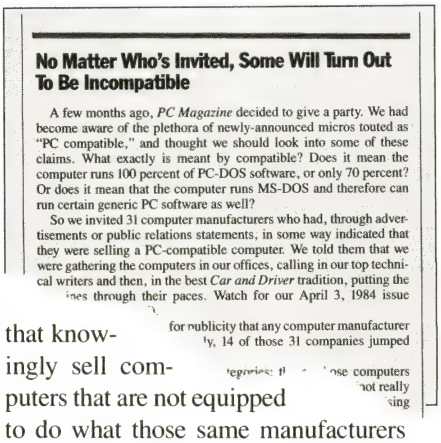
perhaps most articles should pick one part of the spectrum and concentrate on serving it effectively, as long as the overall mix is reasonable.

I'm sure the transition to biweekly publication has made it much harder to keep control over every aspect of the magazine, and I expect that the high quality of *PC* will be uniform once again when things settle down. Meanwhile, I'm happy to be able to lift the magazine and delighted with all the page numbers.

George Avrunin
Amherst, Massachusetts

## Caveat Emptor

In the March 20 issue, Barbara Krasnoff reported in a mild, almost "boys will be boys" tone that there are manufacturers



**No Matter Who's Invited, Some Will Turn Out To Be Incompatible**

A few months ago, *PC Magazine* decided to give a party. We had become aware of the plethora of newly-announced micros touted as "PC compatible," and thought we should look into some of these claims. What exactly is meant by compatible? Does it mean the computer runs 100 percent of PC-DOS software, or only 70 percent? Or does it mean that the computer runs MS-DOS and therefore can run certain generic PC software as well?

So we invited 31 computer manufacturers who had, through advertisements or public relations statements, in some way indicated that they were selling a PC-compatible computer. We told them that we were gathering the computers in our offices, calling in our top technical writers and then, in the best *Car and Driver* tradition, putting the ines through their paces. Watch for our April 3, 1984 issue

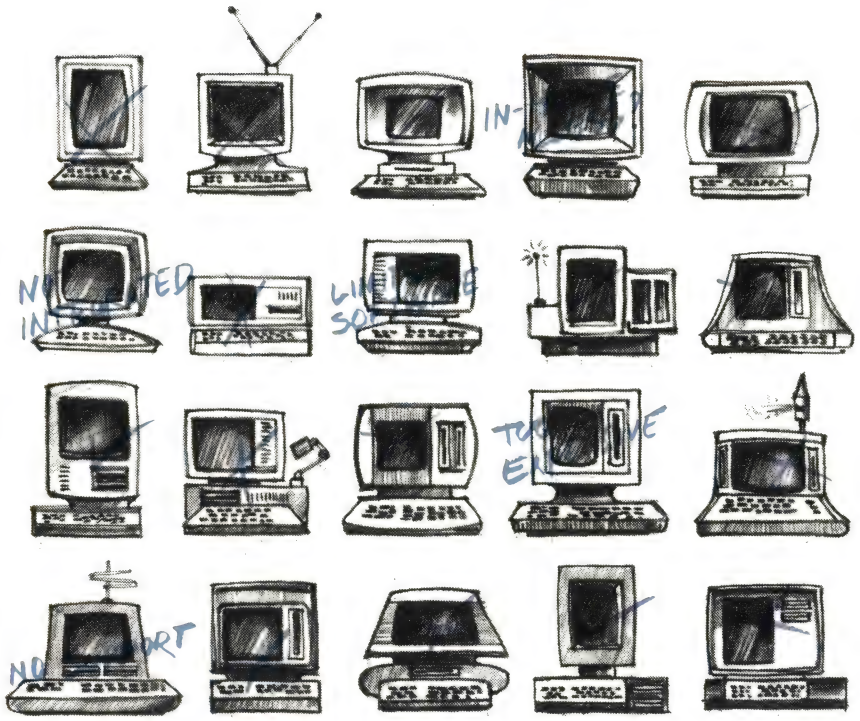
for nublicity that any computer manufacturer
ly, 14 of those 31 companies jumped

egories: t ose computers
ot really
sing

that knowingly sell computers that are not equipped to do what those same manufacturers claim they will do. ("No Matter Who's Invited, Some Will Turn Out To Be Incompatible," *PC*, Volume 3 Number 5, page 57). She referred to that deplorable practice as "predictive advertising," but I think she might have used a more direct adjective—fraud, for example. Were Lamartine alive today, he might have cried, "O Semantics! Semantics! What crimes are committed in thy name!"

Krasnoff concluded with another mild comment on the fact that the buying public reacts to "predictive advertising" with nothing more than a resigned "What did you expect?"

I wonder if Krasnoff has given any thought to another facet of the computer



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industry that, in my judgment, is equally fraudulent—the widespread practice of selling software that the manufacturer knows full well will not perform as advertised. What are bugs, after all?

Computer software selling is a young industry, undergoing profound structural changes. The bulk of the business is concentrated in fewer and fewer hands, and the days of the kitchen table entrepreneur are fading fast. Competition among the survivors will become more fierce. The attitude that the computer industry deserves some kind of special treatment from the public is fatal. Other industries have learned that lesson.

We, the buying public, can accelerate that evolutionary process to the benefit of all by getting rid of the "what can you expect" attitude and by holding computer firms as accountable as we hold other companies.

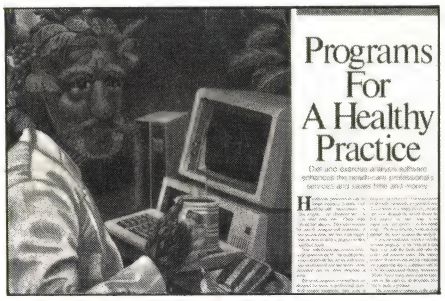
Computer software selling is a young industry, enduring profound changes.

Everyone who is sold defective software or hardware should immediately return the merchandise for full refund, and be fully prepared to pursue legal remedies: registering complaints with the Federal Trade Commission, the local consumer fraud agency, and the local Chamber of Commerce; charging the company with using the United States mail to defraud, where applicable; and even as a last resort, filing suit. The incidence of such outrageously arrogant behavior by computer companies would vanish virtually overnight. But if the prevailing attitude continues to be "what did you expect?", then buyers will continue to get what they deserve.

Irving David Shapiro
Oakland, California

## The PC Cuts Calories

Thank you for reviewing our new program *Evrydiet: A Nutrition and Diet Guide* ("Programs For A Healthy Practice,"




*PC,* Volume 3 Number 4). We agree with Marilyn Schorin's assessment that entering foods can be tedious. I am pleased to say that we have attacked that problem with zeal! For the past month we have been shipping version 1.1, which dramatically reduces the time it takes to enter foods. Contrary to a statement in the review, *Evrydiet* can track special requirements for carbohydrate and cholesterol values; in fact, each user can customize the RDA values for all 24 nutrients. Thank you for this opportunity to comment.

Joe Fargiulo
Evryware
Palo Alto, California

## There's More for the TI

As a faithful reader of your magazine, I would like to commend Winn Rosch on his insights in the review of the Texas Instruments Professional Computer ("Sizing Up The Professional," *PC,* Volume 3 Number 4). I am a proud owner of a TI Professional but also a user of the IBM PC. Both machines are great, but I prefer the TI Professional. I understand that there is a tremendous lead time involved between the testing of a product and the appearance of the review in a magazine, so I would like to point out some facts that Winn Rosch left out. First of all, the memory capacity of the TI is 768K RAM, not 256K. True, the auxiliary memory board made by TI will only hold 256K; however, other boards will hold more. TI has also developed two new boards that fit in the regular slots and will increase the machine's memory to 784K.

There are at least two manufacturers of add-on boards for the TI: Persyst Products of Irvine, California, and Quadram Corporation of Norcross, Georgia. Persyst's Time Spectrum is a multifunction board that can be expanded as the user's needs change. Quadram's board is a RAM memory expansion module. Two companies, Tallgrass Technologies of Overland Park, Kansas, and Zobex of Santee, California, offer hard-disk subsystems for the TI. I'm still searching for others.

After raking Rosch's article over the coals, I would like to say again that I was pleased to see the TI Professional included in *PC*—just dig a little deeper into the topic next time.

Grant Nakamure
Eagan, Minnesota

As a TI-PC owner I am obviously biased, but I believe that Rosch was basically fair and observant in his review of the Texas Instruments Professional computer. However, a few errors leave the wrong impression.

It is true that we will never have the broad base of software support available to IBM PC owners, but the situation is not




nearly as bleak as Rosch paints it. I am writing this with *Wordstar* version 3.3, which makes full use of the TI's cursor keys. TI owners also have TurboPascal, FORTRAN, COBOL, MS-Pascal, PL/I, Forth and other languages available.

Bob Dudley
Coraopolis, Pennsylvania

## Parts of Speech

Vincent Rende's article, "Monitors: A Look Behind The Screen" (*PC*, Volume 3 Number 4), contained inaccurate terminology that I'd like to bring to your attention. According to Webster's, the word *phosphorous* is an adjective, not a noun. It is therefore correct to say, "Owing to the nature of the phosphorous compound . . .", not "the visible trace depends on the characteristic of the phosphorous." The figures provided by Rende all use the correct noun, *phosphor*, meaning any compound that can be made to phosphoresce. CRT phosphors are typically made up of compounds of the rare earths, not the element phosphorus (please note the correct spelling of the noun).

David McManigal
Stormville, New York

## Community Computer

John P. Jennings' wrote in "Letters to PC" that he is searching for a local government program to run on his IBM PC-XT ("Our Town," *PC*, Volume 3 Number 3). The Arizala Corporation has developed such a system based on 10 years of experience with municipal governments. Our software, *Arizala Local Government Management Information System (ALGMIS)*, is currently being used by 30 municipalities in four states. We currently offer general ledger/budgetary, accounts payable, payroll/personnel, and utility billing modules for the IBM PC and the IBM PC-XT. We would be happy to communicate directly with anyone in or out of government interested in knowing more about *ALGMIS*. Our address is: 210 Collingwood Ave., Ann Arbor, MI 48103, (313) 769-6270.

Anne Nauts
Ann Arbor, Michigan

## The PC Goes to Church

I enjoyed reading Barbara Krasnoff's article "The Many Faces Of dBASE II" (*PC*, Volume 3 Number 2). The database that Tom K. Hamilton has written for churches, *Church Membership and Finance*, sounds as if it could fill many of our church's administrative needs. I have been working to enhance the capabilities




of the church's newly purchased IBM PC and would like to learn more about what Hamilton has already done.

Jack Bitzer
Louisville, Kentucky

Our church recently purchased several Kaypro computers and we are designing a *dBASE II* program. I would like to get in touch with Tom Hamilton, who is mentioned in Barbara Krasnoff's article "The Many Faces Of dBASE II". I think the program he has developed and offers to churches will be worth our investigation.

J. Stephen Spence
Virginia Beach, Virginia

*Tom Hamilton's program is distributed by Regency Software Marketing, 2511 Bryden Rd., Columbus, OH 43209, (614) 231-9773. If users have technical questions, Hamilton can be contacted directly care of Columbus Consulting Company, 1998 Collingwood Rd., Columbus, OH 43221, (614) 486-6043.—Ed.*

## A Conscious Delay

I read the article on the slowdown of *MultiMate* with interest because I had just received my upgrade ("MultiMate Word Processor Slows Down in New Version 3.20," *PC*, Volume 3 Number 4, page 59). The slower response time of disk updates is only part of the problem. There is now a just barely perceptible delay between the time a key is pressed and when it appears on the screen when using a color monitor. When you're overstriking existing text, the delay increases so much that the screen is several characters behind the keyboard. Since I compose at the keyboard and watch the screen simultaneously, this sluggishness is a very real distraction. I may stay with version 3.11 of *MultiMate* most of the time and use 3.20 for its really excellent spelling dictionary.

Richard Werbin
New York, New York

*The people at SoftWord,* MultiMate*'s manufacturer, are aware of this slowness and plan to release an updated, faster version soon.—Ed.*

## A Left-Handed Compliment

A new PC and you didn't tell us about it? The photo on page 161 of the February 21 issue of *PC* (Volume 3 Number 3) clearly shows a PC-XT with the disk drives on the left, vents and speaker on the right, keyboard with number and cursor pad on the left, and monitor similarly modified.

What joy, what bliss! At last, a PC for us left handed, inverted y-axis-reading hackers. Just think of the confusing codes I could produce with this beauty. Only one problem: My local IBM Product Center and Computerland have never heard of the TX-PC. How about a review?

Daniel Ehrmann
Chicago, Illinois

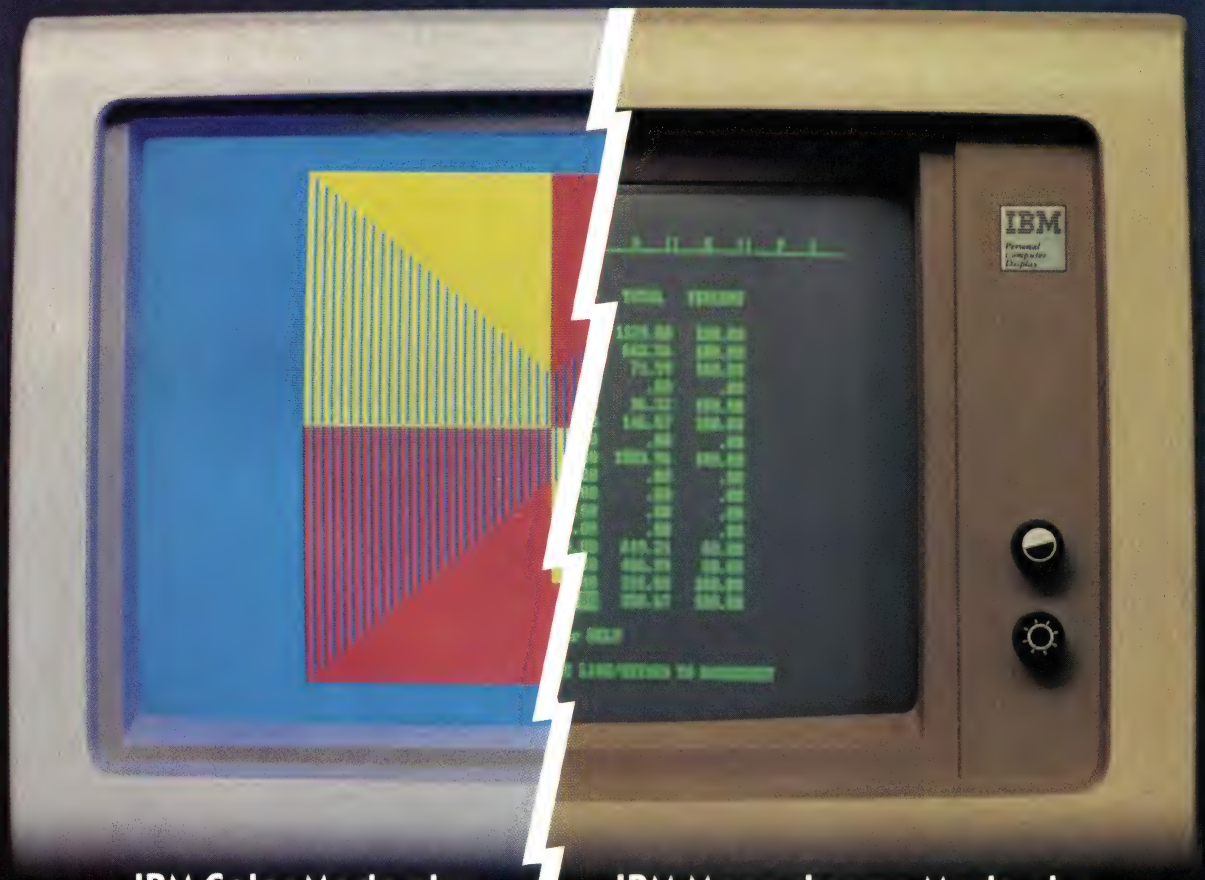
What's wrong with the picture on page 161?—Ed.

## Just One Stroke

I understand that computer usage by handicapped people is a concern of many in the computer field. I have an idea that might make computers easier for everyone to use but that might be particularly useful for those who have difficulty pressing more than one key at a time.

Peter Norton, in one of his books, refers to a less radical way than Ctrl-Alt-Del to reboot the machine. He says that typing in COMMAND at the A prompt

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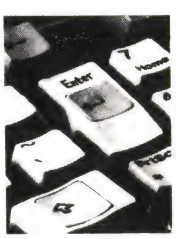
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will accomplish the same thing but without running through the hidden files of the system. I used *ProKey* to assign COMMAND and ENTER to F10, and with one key stroke, I can now reboot my PC.

Ed Lucash
Kent, Ohio

*Thanks for your suggestion. For other examples of how handicapped people can use the computer, see: "For The Handicapped: Toggling Shift Keys"* PC, *Volume 3 Number 1; "Handicapped Computing,"* PC, *Volume 2 Number 7, page 55; and "Toggling Control Keys,"* PC, *Volume 2 Number 1, page 74.—Ed.*

### PC Waters the Lawn

My business, a large wholesale flower grower occupying about 15 acres, has had a PC for a year. Our primary use for the PC is accounting and database management. Currently our irrigation system is electronically controlled by mechanical and solid state watering clocks, but I would prefer to have the PC do our watering. Our biggest stumbling block is finding the proper hardware to connect the PC to the relays that control our electric valves. I have read articles about individuals who have programmed their computers to water their lawns and turn lights on and off, and I feel my requirements would be similar. Got any ideas?

Tim L. Myers
Bradenton, Florida

*Readers, any suggestions?—Ed.*

### Music, Sweet Music

I enjoyed the book excerpt by Bernd Enders and Bob Peterson ("The Sound Of Music," *PC*, Volume 3 Number 4). I found it interesting and informative, but I did find an error in the music-making exercise on page 186. Line 130 of the program listing should, in fact, end with "O2G+O3CD+" instead of "O2G+CD+".

Douglas R. Jackson
Gainesville, Florida

## Good Work

Today I received my copy of *PC Magazine* with the first installment from Robert Lafore's *Assembly Language Primer for the IBM PC*. ("Assembly Language: More Basic Than BASIC," *PC*, Volume 3 Number 3). Wow! We at The Waite Group feel that this is the best job we have seen of excerpting a book by a magazine, and we would like to express our sincere thanks to all involved. Your editorial staff has been extremely diligent and professional, and the results show it. The quality of the graphics is exceptional, the treatment is professional, and the position of the article in the magazine is ideal. We all look forward to seeing the rest of the serialization.

Mitch Waite
The Waite Group, Inc.
San Rafael, California

*Additional installments of Robert Lafore's* Assembly Primer for the IBM PC *appear in* PC, *Volume 3 Number 5, 7, and 9. It's always good to hear that our work is appreciated. Thanks for writing.—Ed.*

## Corrections:

In "Dysan 3.25" Disks With Hit Software" (PC News, Volume 3 Number 5, page 52), the first paragraph should refer to a 5.25-inch disk. Also, the size of the Dysan Flex Diskette is 3.25 inches.

Several equal signs were omitted from the two figures on page 389 of "Handling Strings with MUMPS" (*PC*, Volume 3 Number 6). For those readers who were understandably confused, here are the corrected figures:

*Figure 1:*

**VARIABLES:**

STR="ABCDEABCD"
SUBS="CD"
D1=1,D2=2,D3=3

| COMMAND | RESULT |
|---|---|
| C=$E(STR,1) | C="A" |
| C=$E(STR,D1) | C="A" |
| C=$E(STR,D2,D3) | C="BC" |
| C=$F(STR,SUBS) | C=5 |


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|---|---|---|
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| Ashton-Tate: FRIDAY | $295 | $199 |
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# LETTERS

C=$F(STR,"AB",2) C=8
C=$L(STR) C=9
C=$L(STR,SUBS) C=3

*Figure 2:*
REC="Baker,D.;32;W;M;S;1/1-2/12-7/21"

| COMMAND | RESULT |
|---|---|
| C=$L(REC,";") | C=6 |
| C=$P(REC,";",1) | C="Baker,D." |
| C=$P(REC,";",2,5) | C="32;W;M;S" |
| C=$P($P(REC,";",6),"-",1) | C="1/1" |

The caption below the drawing on page 60 in "PC News" (*PC*, Volume 3 Number 6) should have been: Drawing by Levin; © 1984 The New Yorker Magazine, Inc.

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In "APL: A Language for Modern Times" (*PC*, Volume 3 Number 6), the APL upgrade symbol ( ⍋ ) was rendered incorrectly. It occurs four times on page 232, mistakenly preceded by the letters *APL*. In column 2 of the same page, 5 lines from the bottom, the words *return* and *'BEST'* should be on separate lines; the type style of the former should be text roman. Six lines above this are the words *something like* followed by a blank space that should read X[ ⍋ X]. In column 3, line 17 from the top, X[ □ AV □ X;] should read X[ □ AV ⍋ X;].

---

In "The Sound of Music" (*PC*, Volume 3 Number 4), on page 184 the symbol OO1 should be a treble clef sign, OO2 a bass clef sign, and OO3 a natural sign. None of these three-character symbols is used in BASIC's PLAY command.

---

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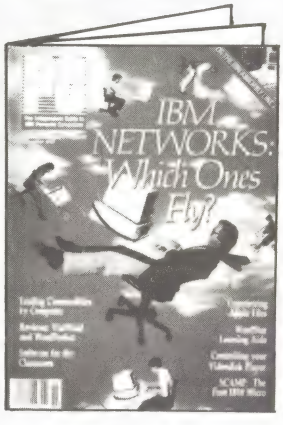
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# Sing a Song of PL/I

Norton rediscovers an old favorite, PL/I, in a new incarnation by Digital Research. This fully featured language makes his new loves, Pascal and C, look Spartan by comparison.

As many people know, I'm a programming language enthusiast. I love 'em, especially ones that satisfy my taste for structured languages, cleanliness of programming, and handy and powerful features. Whenever I've commented on programming languages for the PC, mail comes pouring in from those who feel that I've slighted Digital Research's family of languages, PL/I in particular. Today, by popular request, I sing a song of PL/I, my first love in programming.

## History Lesson

The history of PL/I is an interesting one. In the old days of mainframe computing, there were two basic types, commercial people who programmed in COBOL and scientific folks who programmed in FORTRAN. And, IBM had quite different machines to fill the two needs. Everybody knew that this separation wasn't a very good idea, so IBM created a unified group of compatible computers, the famous System 360. (Now that IBM is spinning off our beloved PC into a whole line of compatible personal computers, the industry is saying, "IBM is doing another 360.") To go with this integrated line of 360 computers, IBM wanted to create an integrated programming language that would do the work of COBOL, FORTRAN, and more. The result was PL/I, which stands for "programming language one."

PL/I was a great idea, in many ways far ahead of its time. It wasn't until some years after PL/I's creation that the structured programming concept was developed, yet PL/I was a "structured" language from its very beginning. Unfortunately, PL/I didn't catch on too well in the mainframe world, partly because lots of deadheads really liked everything that was wrong with COBOL and FORTRAN, partly because PL/I was too complex for the average programmer to master, and partly because IBM's efforts to tell people how to program raised anti-IBM hackles. (Haven't you noticed that the success of the PC has brought lots of anti-IBMers out of the closet again?)



Peter Norton

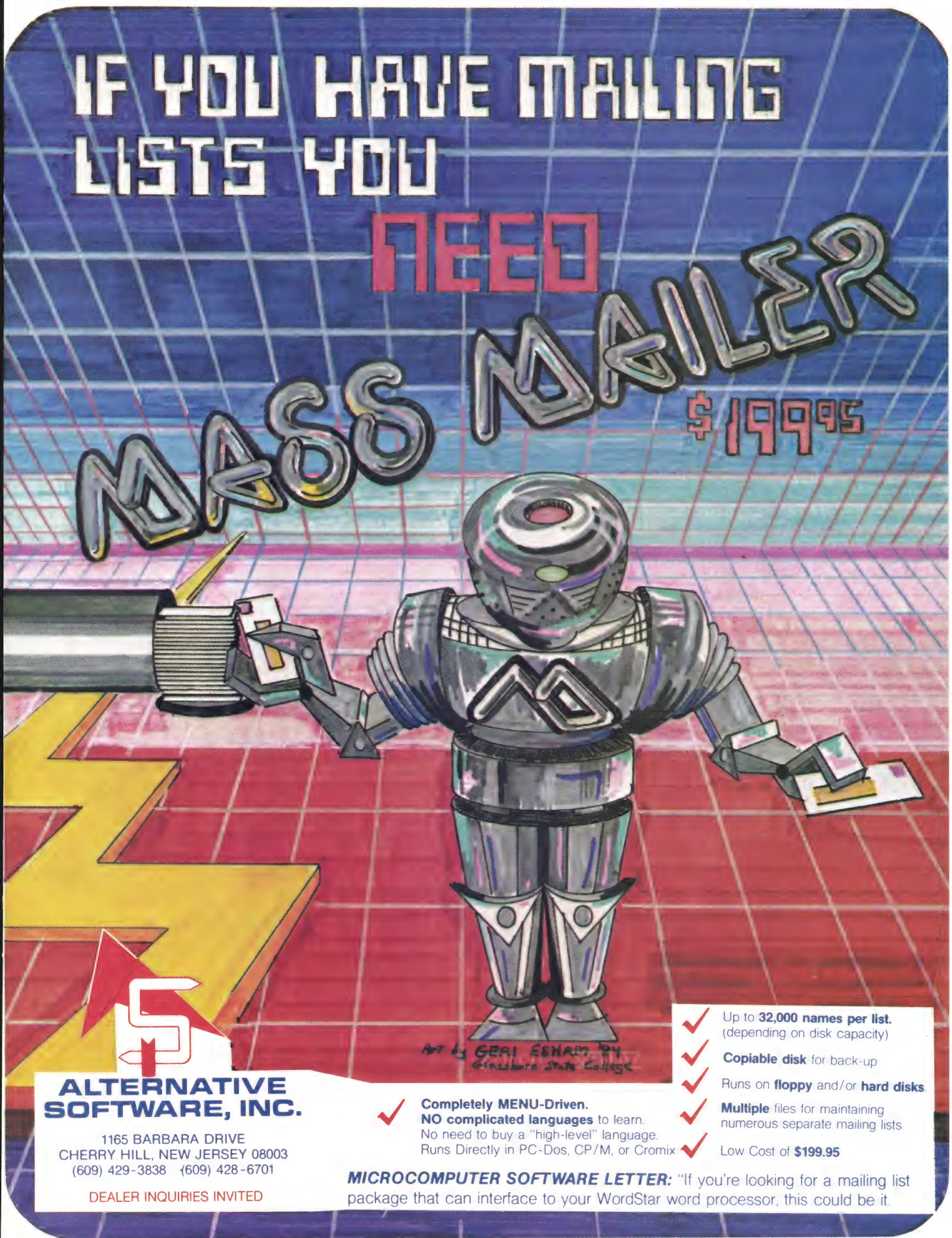
Fortunately for us, the folks at Digital Research, who know a good thing when they see it, created a microversion of PL/I. It's been available for 8-bit computers for some time and lately for our PC as well.

## PL/I's Features

What's PL/I like? In style and format, PL/I is somewhat similar to both Pascal and C—about as similar to them as they are to each other. Anyone who has learned to read either Pascal or C will be able to easily read PL/I programs. In fact, I'd say that it's easier on the whole for a beginner to read and understand a PL/I program than programs in most other languages because its design is both clean and flexible. This clarity is a plus: you can learn PL/I quickly by studying examples, and Digital Research's compiler comes with a ton of them.

What really sets PL/I apart from its competitors (which unquestionably are Pascal and C) is that it is a language rich in features. It has so many features, in fact, that it's hard to summarize them. I'll try to cover the most important ones to give you a more concrete idea of what PL/I's strengths are.

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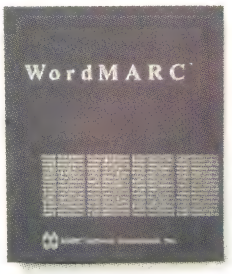
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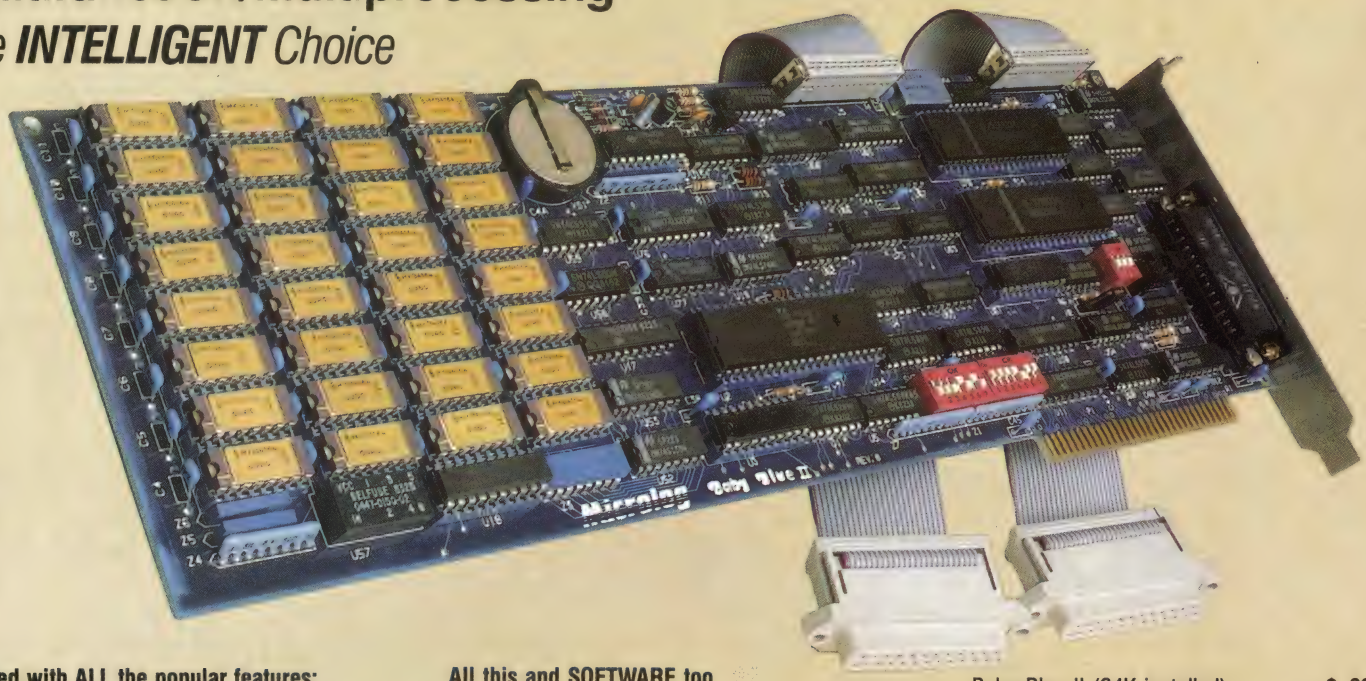

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more ways to work with numbers than any other PC language that I know of. String handling is particularly good. PL/I makes it easy to define and manipulate both fixed- and variable-length strings. In Pascal and C, string handling is a weak add-on, but in PL/I, it's defined into the language. PL/I has many powerful string-handling functions such as SEARCH, REVERSE, and TRANSLATE. Its string features are as good as or better than those of any other language, and in my experience, programmers spend a lot of their time working with character strings.

PL/I also really shines in its input and output formatting. Many languages—especially C and Pascal—have rather weak, clumsy, and inflexible I/O features. If anything, PL/I gives us too many powerful options and features for formatting data and performing I/O functions.

In addition, PL/I has interrupt handling and error trapping features that neither Pascal nor C have. Among the commonly used PC languages, BASIC is the only other one to my knowledge that lets us write programs that can trap and act on errors and other special conditions. If you don't like programming in BASIC but want these features, you'll find them in PL/I.

### PL/I's Components

The best way to understand PL/I's strengths and features is to understand what went into creating it. When I summarized PL/I's history, I mentioned that it resulted from an effort by IBM to satisfy the combined needs of commercial and scientific computer users. Actually that effort was far broader; roughly speaking, PL/I was built out of four parts: FORTRAN's calculations, COBOL's I/O formatting, Algol's structure, and some new topics.

The traditional FORTRAN school contributed not only handy calculation-by-formula but also automatic calculation with whole arrays of data, one of the main virtues of the language APL. The COBOL camp contributed very powerful I/O formatting, particularly through an option called PICTURE; formatting using the PICTURE option allows such nice things as floating dollar signs and commas in numbers (BASIC programmers have a crude form of this feature in the PRINT USING statement). The ALGOL language (which isn't widely known these days) contributed such features as a free format for program layout, and block structuring, which helps us make sure that one part of a program doesn't interfere with another. Anyone who is familiar with Pascal and C is accustomed to these virtues; they were not only uncommon when PL/I was created, but PL/I's versions of these features are probably better than those of any language created since. The final element, which I called new topics, consisted of several abilities that had not existed before in major programming languages. These included support of interrupts (similar to BASIC's ON KEY and ON ERROR statements), use of macros and program libraries, and other goodies of that ilk.

As you can see, PL/I is extraordinarily rich in useful features. It puts more power and more goodies into our hands than any other language. However, it also means that mastering PL/I is a much bigger undertaking than mastering other programming languages, not because PL/I is particularly hard to learn, but because there is so much to it. Its power is what's best and what's worst about PL/I.

### PL/I for the PC

Digital Research's version of PL/I, called PL/I-86, comes in both a CP/M-86 version and a DOS version, so we can use it in the PC's standard DOS environment. PL/I-86 is based on the popular Subset-G of PL/I, a version of the language in which the grossly complicated features have been stripped off but the most useful ones retained.

My tests of DR's PL/I-86 showed that it was very nice. The compiler is nearly bug free (and I didn't find any bugs in it on my own). It compiles reasonably fast—in 2 minutes flat for a 28K source program—and produces code and finished programs comparable to those in IBM and Microsoft's Pascal.

The manual that comes wth PL/I-86 is fat, thorough, and easy to understand. It's as good and as attractive to read as any I've used. On all these tests PL/I-86 scores high.

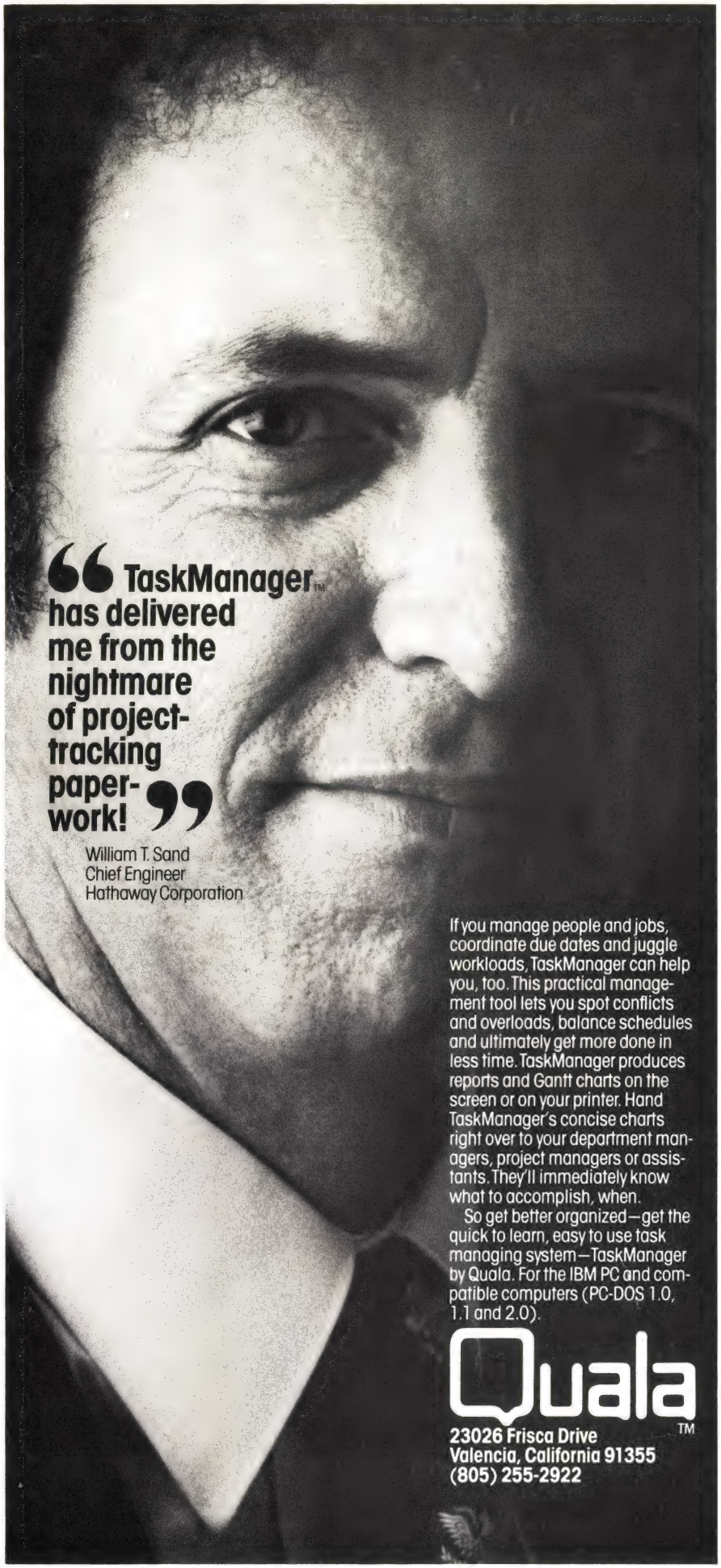
> What really sets PL/I apart from its competitors is that it is a language rich in features.

PL/I-86 has one minor quirk that you ought to be aware of if you are considering it. Most DOS compilers are designed to use DOS's own linker to combine programs and library modules. That linker isn't in DR's style, however. PL/I-86 comes with its own DR-style linker and libraries, which means that we can't develop PL/I-86 programs the same way that we do in standard PC languages. While I'm not fond of that quirk, I'd rate it as a minor nuisance at worst; DR's style of linking is easy to master once you've used the DOS linker, and PL/I-86 comes complete not only with a linker but also an assembler that allows us to write assembly interface modules compatible with the PL/I-86's linker. In addition, PL/I-86 comes with a subroutine librarian program. Hallelujah! A librarian is sorely missed in PC-DOS—when IBM wrote PC-DOS, it cheated us of the one that normally comes with MS-DOS.

All in all, I find Digital Research's PL/I a very good product. Now, should you use it? That depends on your perspective.

### Another Language?

Although I may sound like Scrooge, I say that we already have too many pro-






gramming languages and that we'd all be better off with fewer for roughly the same reasons that we'd be better off with fewer spoken languages. I'd like the Tower of Babel to be shorter, not taller. From this perspective, PL/I is like an unwelcome extra guest at an already-crowded party.

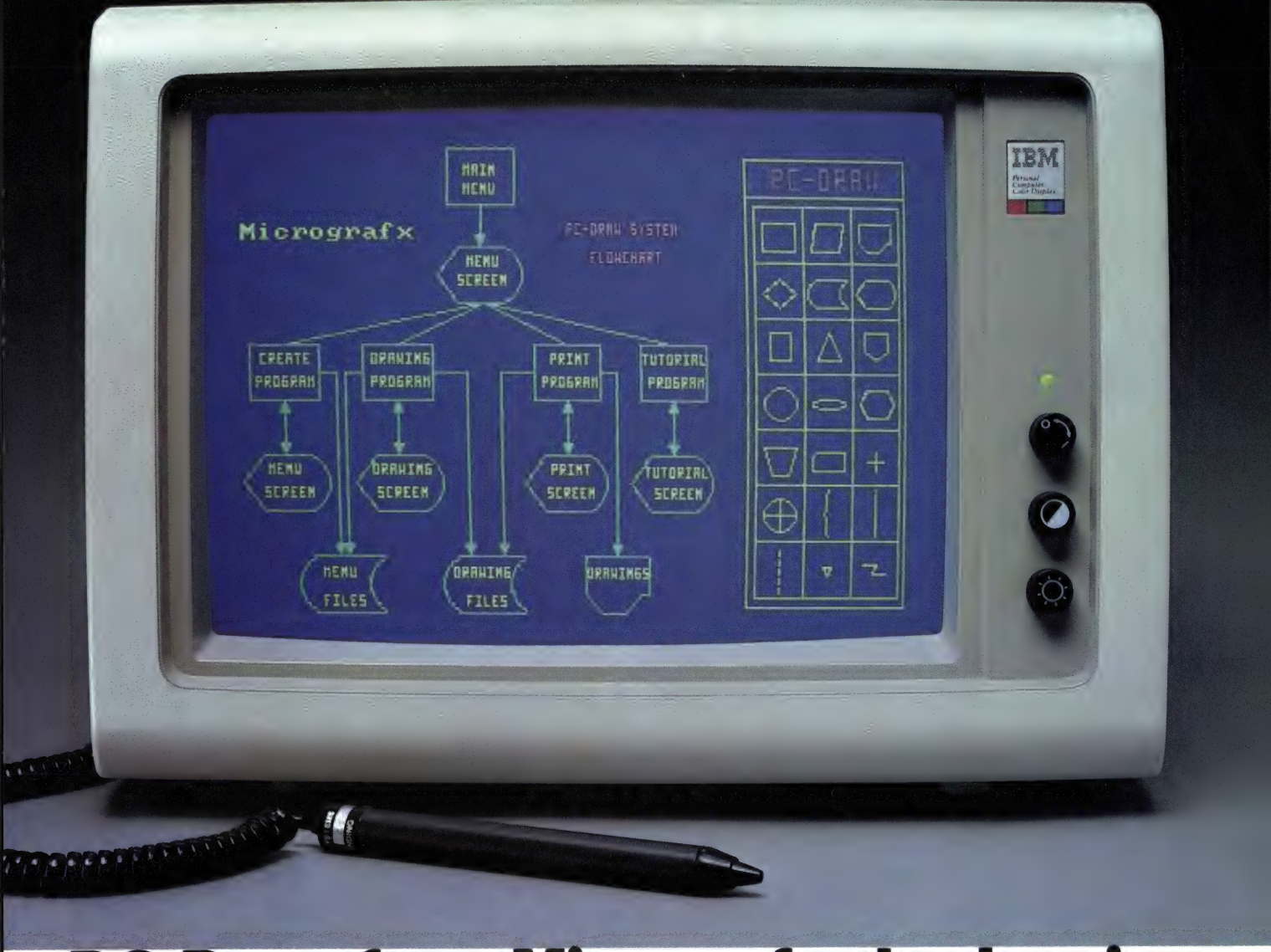
But for those who believe in letting a thousand flowers bloom, I say PL/I-86 is terrific. The language is wonderfully rich and powerful, and the compiler seems excellent. For its strong features alone, PL/I should be considered by anyone who wants the closest thing to the ultimate in programming.

Although I may sound like Scrooge, we already have too many programming languages and we'd all be better off with fewer.

I'm a true believer in structured programming, which I think is the most reliable way to write programs. For good structured programming, you ought to be using a well-structured language. Pascal and C qualify, but PL/I adds significantly to our range of choices because it has so many programming goodies. C is a very lean and austere language with few features, and although Pascal is less austere, it's still a language for feature Spartans.

If you are choosing among these three languages, start by considering Pascal, a sound, solid language with excellent safety features. If lean and mean programs are what you are after and you don't mind a few extra programming errors, look north to C. If super flexibility and powerful features are what you are after, at the expense of longer programs, look south to PL/I.

And if you still love BASIC, don't look to me for advice. ■




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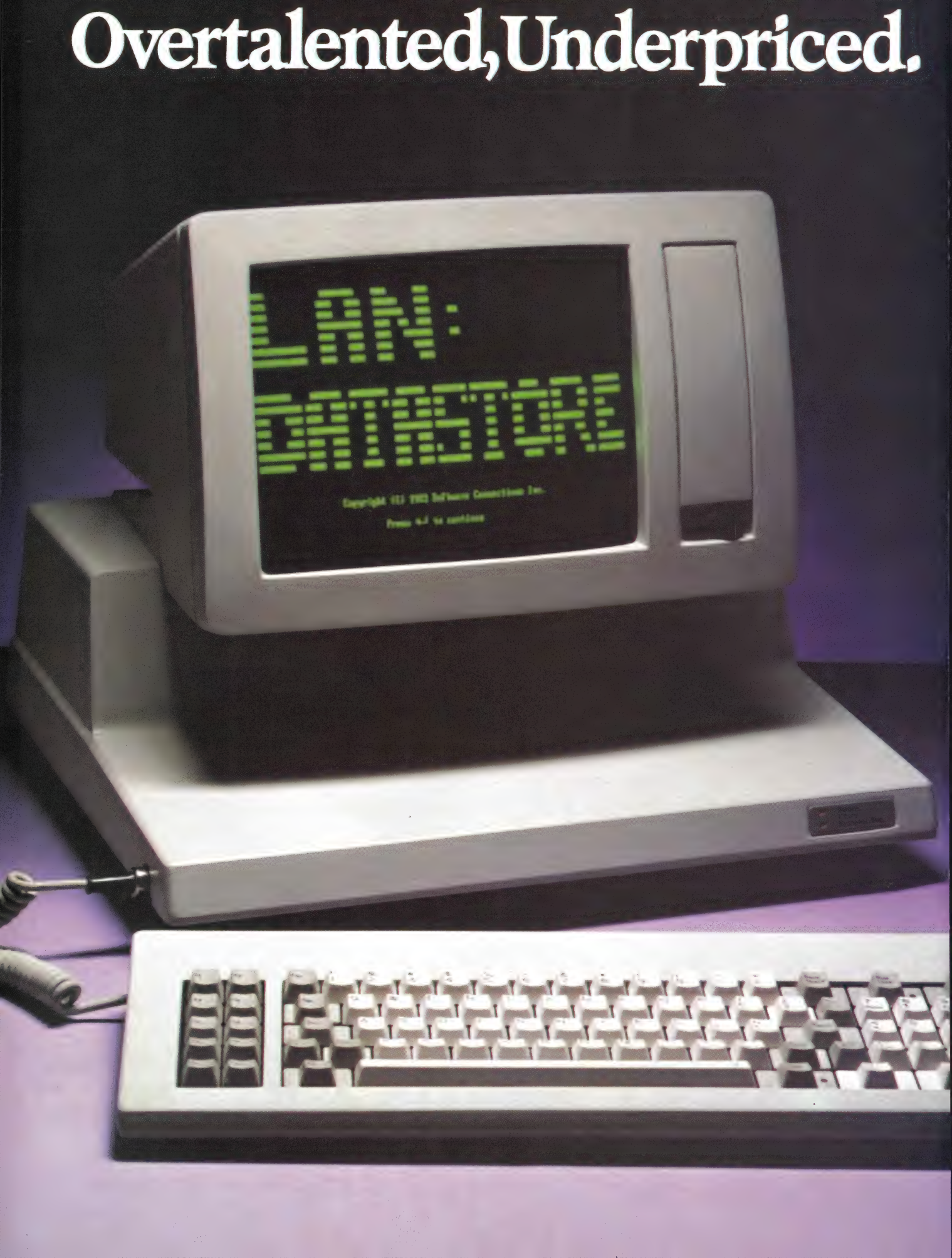
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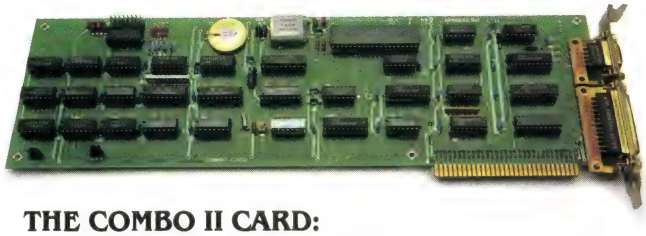
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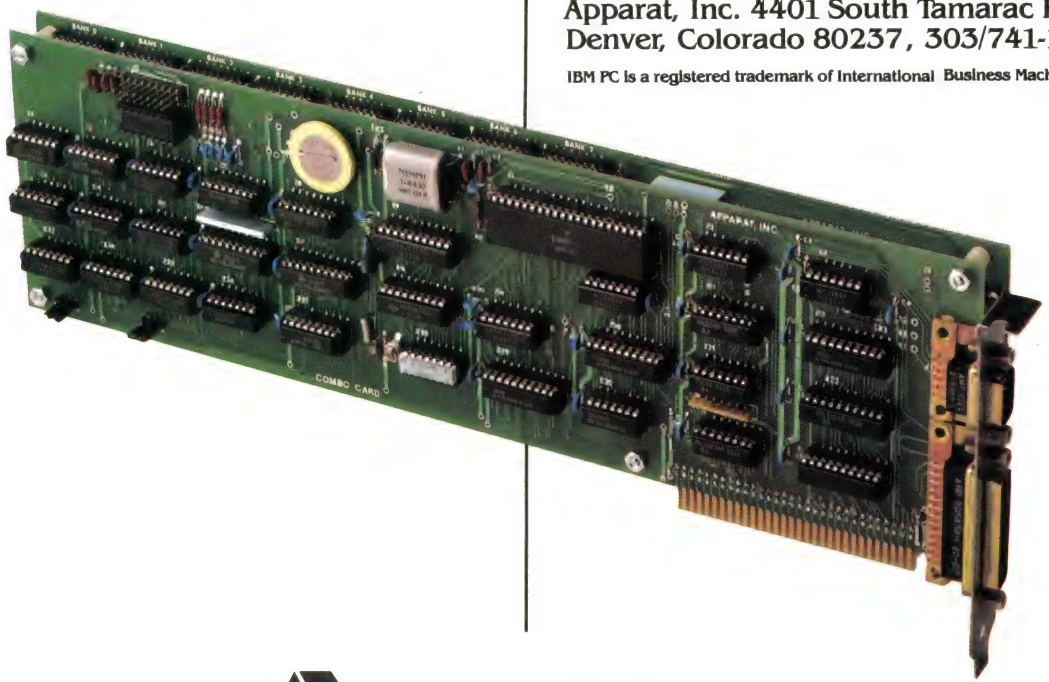
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COVER STORY • PAUL SOMERSON

# SUPERCOMPUTER POWER & THE PC's FUTURE

We're still in the infancy of personal computing. Like it or not, our prized PCs are just powerful toys. Cray's top-of-the-line machine can perform a billion operations in a second. Engineers are using supercomputers like the Cray to cram astonishing speed and power into the next generation of chips. The price and size of these supercomputers are shrinking dramatically. You may have the power of a supercomputer at your fingertips sooner than you think.



There is considerable speculation these days concerning the next incarnation of the IBM PC. Everyone expects it to be far faster and more powerful. Most observers predict that it will contain an 80186 or 80286 chip, faster RAM, and vastly improved graphics. But all this is really just a baby step. The real question is what kinds of machines we'll all be using in 5 or 10 years. And the answer is nothing short of astonishing.

In the middle of this century, a handful of researchers needed a way to calculate the trajectories of artillery shells very quickly and sketched the plans for the first electronic computer. The hardware they built used tens of thousands of radio tubes, consumed vast quantities of electricity, and took up a large room. But it did allow extremely rapid calculation and became the envy of the scientific community.

Today, even IBM's low-end PC*jr* can run circles around that jumble of hand-soldered joints and throbbing glass diodes. But the technology that spawned the Apple and the PC and their host of imitators is nearly a decade old. With the market for micros exploding, and technological competition proceeding apace, we may have tiny computers on our desks with awesome abilities sooner than we think.

The most powerful machines on the market—dubbed supercomputers—are being built by companies such as Cray, CDC, Fujitsu, and Hitachi. While these massive devices are designed to do complex calculations at speeds that leave micros gasping, most of the engineering advances that boost supercomputer speed and power can benefit PCs as well.

Future increases in microcomputer performance will result from better chip construction and design. Supercomputers are already helping integrated circuit developers optimize the layout of beefier chips; as an example, Bell Labs' new 256K RAM could not have been created as easily without the help of its speedy Cray. As recently as 2 years ago, American manufacturers had the supercomputer field all to them-

Illustration: Mike Konarek

selves. But, spurred by government-funded programs to wrest dominance of this field eastward, Japanese computer producers are now selling supercomputers as powerful as Cray's, and are hinting that future releases will put America's top products to shame.

This race for technological supremacy can only help PC users. Researchers at most of the top computer companies are experimenting with radical new chip designs and materials. One promising area of study centers on using gallium arsenide (GaAs) substrates rather than silicon; this has the potential of speeding up processing by a factor of five. Other processes under study promise to make custom fabrication of chips quick, easy, and inexpensive. Such advances in design and construction will percolate quickly to the PC market.

Today's supercomputers can perform a billion operations per second, far more than the few hundred thousand cranked out by the PC's humble 8088. What will the desktop (or the wrist-top) of 1994 be like? Odds are that it may have much of the speed and power of today's Crays.

IBM is not going to stand idly by and watch other manufacturers edge it out of the PC market. It very much wants to maintain its position as the microcomputer leader. If this means rocketing the PC's speed and power skyward to head off the competition, you can bet it will be done. And, the battle for supercomputer supremacy will have an impact on the PC as new integrated circuit designs and materials reduce the cost and increase the computing ability of a new generation of chips.

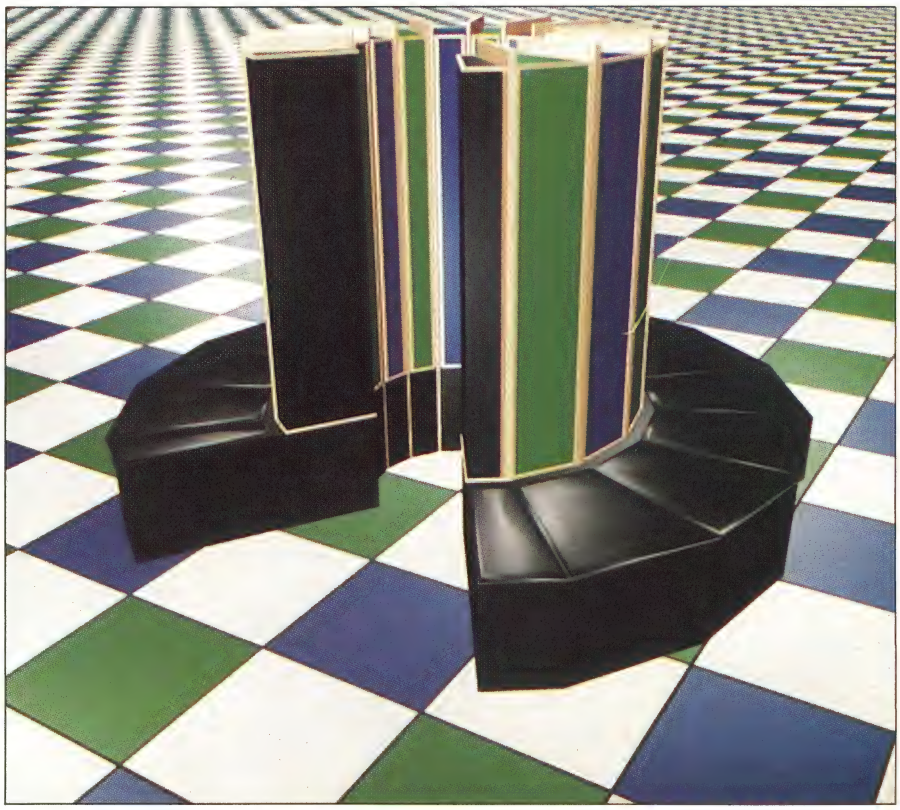
The PC of the 1990s may indeed have the power of today's Cray. But what does this mean? What's so special about such fast computers? How will you use them? The following articles suggest some of the capabilities PC owners may have at their fingertips in the decade ahead.

**This and the following illustrations were generated on a variety of Cray computers, and represent true state-of-the-art computer graphics.**

You don't run 1-2-3 on your Cray. You use it to squeeze 100 million extra barrels of oil out of your favorite oil field or track the 2,000 threatening weather fronts all over the globe.

The Cray looks vaguely like something a space voyager would see jutting from the surface of Jupiter through a swirling methane fog. Hollywood wanted to audition it for the role of WOPR in the movie *WarGames* but was turned down. There are only 80 or so of these nimble giants in operation at an average cost of around $10 million a pop. The newest ones can perform one billion calculations in a single second. They're so powerful you have to plug them into large mainframe computers just to handle the blazing input/output. And the limiting factor most perplexing to its engineers at this point is the speed of light.

You don't run *1-2-3* on your Cray. You use it to squeeze 100 million extra barrels out of your favorite oil field, track the 2,000 threatening weather fronts all over the globe, crack genetic and spy codes, or coax an extra megadeath out of your best nuclear warhead. If the software were available at your local Byte Shop, it would have names like *NukerCalc* or *WarStar*.



When you see the words "game over" while playing a Pentagon version of *Missile Alert,* it really means game over.

## MIPS, MFLOPS, and MOPS

This is a world of MIPS and MFLOPS and MOPS (millions of instructions per second, millions of floating point operations per second, and millions of arithmetic/logical operations per second). A supercomputer is loosely defined as a machine that can perform at least 20 million computations per second. The Cray X-MP, running at a machine cycle time of 9.5 nanoseconds, is capable of an overall instruction issue rate of more than 200 MIPS and computation rates of over four hundred 64-bit MFLOPS and 1 billion MOPS. That's fast. Even if you don't know anything about computers, it sounds fast. And supercomputer progenitor Seymour Cray has plans for new models that will put even these to shame.

So do several single-minded teams of Japanese scientists. There's a storm brewing over the tepid American efforts to keep pace with racing Tokyo technology. Growing numbers of vocal computer Cassandras in this country warn that global leadership in technology is swinging eastward. What makes these predictions especially chilling is that computers are becoming increasingly enmeshed in most phases of daily life. While the international battle for the next computing technology is currently focused on supercomputers, the advances gained in this area will no doubt spiral down into the burgeoning population of conventional mainframes, minis, and micros, and even cars and appliances.

Cray Research currently manufactures four products built around two central processors, the Cray-1/M and the Cray X-MP. A futuristic new system, the Cray-2, is expected to be in production in late 1984. Eighty percent of all the supercomputers in the world are Crays; two-fifths of these are used "to support some type of energy research at U.S. Department of Energy National Laboratories and similar facilities in Germany, France, and the United Kingdom," as Cray gingerly phrases it. The energy they're researching is the kind favored by Dr. Strangelove. Two-thirds of all Cray sales are to foreign customers. Governments are the prime buyers, accounting for half of all purchases. The rest are split fairly evenly between universities and businesses.

In 1982, the company announced its Cray-1/M (the *M* stands for Metal oxide silicon memory). It worked about the same as Cray's older supercomputers, but because of its MOS circuitry, was half the size and price. The 1/M now goes for about as much as the typical top-of-the-line IBM mainframe, and Cray salesmen are eager to convince corporate MIS executives to replace their less powerful machines with entry-level supercomputers like this one. According to Cray CEO John Rollwagen, this should "open up the market" for the Cray X-MP (which stands for experimental, extraordinary multiprocessor), introduced 2 years ago, which sells for the same $10 million to $14 million as the original Cray-1 but has up to five times the computing power and a raft of nifty extras you just don't get with your PC. Rollwagen admits that the real profits lie with the X-MP and the even newer Cray-2, a Tom Swiftian machine 3 years and $20 million in the making with a dozen times the power of the Cray-1.

## One Supercomputer to Go

You can take a supercomputer home for as little as $4 million, but the newer models carry a hefty $14-million price tag. And remember, you also have to own a pretty beefy mainframe or supermini that you can plug your Cray into. Still, if you want to trade your Cray in for next year's model, you won't have to toss your expensive programs. Seymour Cray ensures that all his newer machines are software-compatible down the entire line.

Is a Cray just an astonishingly souped-up version of a PC? Well, yes and no. On one hand, they're both a collection of CPU and I/O chips. A decade from now, according to one Cray researcher, the semiconductor industry will turn over $90 billion annually. Chip speeds and abilities are continually climbing skyward, while prices plummet. Replacement chips that boost performance and typically cost 20 to 30 percent less than their outdated versions are announced each year. And engineers estimate that chip densities and the resulting power and speed can increase by a factor of 100 before reaching the fundamental limits of technology, although some argue that we're far closer to that barrier than we realize.

Twenty years ago, the guts inside integrated circuits were approximately 25 microns wide. Today, the same components are commonly 3 microns wide, and manufacturers are adopting 1.5 micron technology. The industry has moved in this period from small-scale to large-scale integration, where circuits contain from 1,000 to 100,000 devices. These days, in certain forward-leaning industries, very-large-scale integration (VLSI)—packing

You can take a supercomputer home for as little as $4 million, but the newest models carry a hefty $14-million price tag.

Illustration: Digital Productions, Los Angeles

up to 10 million devices on a chip—is standard. In 20 more years, ultra-large-scale integration, with far more than 10 million components per chip, will be the rule. Motorola technological strategist J. Jeffrey La Vell predicts that by the beginning of the next decade the figure may be as high as 20 million per chip, compared with the half-million on your average 256K RAM chip today.

Chip developers have compared the process of engineering a typical chip to "designing, mapping, and monitoring the highway system for metropolitan Los Angeles in an area 1/20 the size of a postage stamp." Cray Research scientist Kelly Wild explains: "After mapping all the streets and highways onto that small area, one would have to keep track of where each street led. All possible routes to any given location in the micro city would have to be tracked. In addition, the length of time required to arrive at any location taking any possible route would have to be known. One would be required to monitor all traffic lights in the system and note which ones were red, yellow, or green at a given point in time. Information about which streets had high or low volume traffic, in which direction, and at what times of day would have to be available upon request."

A two-transistor, five-part circuit cost $10 in 1960 and 10 cents in 1978. Wild quotes some engineers as predicting that La Vell's 1990-vintage chip will sell for one-tenth of a cent. Supercomputers will be both the beneficiaries of this leap in technology and part of its cause. Chip designs have become so complex that it may soon take a supercomputer to puzzle them out efficiently. If this is true, whoever controls supercomputers will have a lock on future computer development.

The 256K dynamic RAM that many say will be the memory mainstay for the rest of the decade has already benefited from the power and speed of the supercomputer. Bell Labs used a Cray-1/S extensively in developing its 256K VSLI chip. Circuit simulations that normally took 4.4 CPU hours on Bell Labs' Honeywell HIS 6080 were dashed off in 20 minutes on its Cray. Crays typically outperform the superminis commonly used for such circuit analysis by a factor of 100 or more.

### The Cray X-MP

Cray's X-MP, the best American technology you can buy today, resembles a sort of squat, space-age Stonehenge. Twelve vertical columns form a 270-degree arc. In each column are twin chassis containing as many as 72 chip-crammed modules. The power and cooling hardware nestle around the Cray's ankles inside the most expensive curvilinear benches in the world. And it's petite on a computer scale; the whole works tips the scales at 5.25 tons but takes up a modest 100 square feet of floor space.

The X-MP boasts a pair of identical CPUs, each more powerful than the single CPU in the Cray-1 (which itself is no slouch). These two central processors are carefully synchronized through clusters of shared registers in the CPU intercommunication section and through the central memory.

So much thermal energy boils off the Cray-2 that its engineers decided to dunk the whole unit permanently in a tank of pure liquid fluorocarbon.

The X-MP is designed to hook into Cray's Solid-State Storage Device (SSD), which gives users as much as a quarter gigabyte of on-line storage. This is like having a RAMdisk that can salt away the data contained on 1,600 single-sided floppies. The unit weighs in at a cool ton and a half, takes up 10 square feet of floor space, and needs an internal refrigerator to keep it from melting. A broadband data transfer channel scoots bits back and forth between it and the mainframe at burst rates of 10 billion per second. For short random or long sequential transfers, the SSD beats disk storage by a factor of 50 to 100.

The CPUs are built around 16-gate array circuits, which help give the X-MP its 9.5-nanosecond clock cycle time (compared with 12.5 nanoseconds on the 1/S) and 38-nanosecond memory bank cycle time. Its four parallel memory access ports and lickety-split CPU yield eight times the total usable memory bandwidth of the Cray-1. Competitive supercomputers have red hot specs too, especially some from Japan. But take a second to stop drooling and see exactly what this means.

Cray benchmark expert Mike Ess explains: "The problem is not the maximum theoretical numbers of bandwidth or MOP rates, but what percentage of those maximum numbers you can get to the user. Fujitsu, Hitachi, and NEC are all boasting higher MOP rates, but those numbers don't mean anything if the user can't get at them. It's a question of software and application. Some applications just can't run at those speeds. Some can't be vectorized. Some calculations involve several IF tests before you ever do a multiply or divide, which slows the pace to a relative crawl."

The new Cray-2 CPU will measure a compact 2 feet by 3 feet, one-tenth the size of the Cray-1 CPU. No wire will be longer than 16 inches, compared to 4 feet in earlier Cray versions. In a vacuum, light travels 1 foot per nanosecond. Electrons



coursing down a wire move at about a fifth of that rate. Much of the delay in high-speed computing is in shuttling data back and forth over miles of wires. Each supporting chip module will be eight layers thick to further reduce the length of connecting wires.

But wedging chips next to each other to reduce the signal travel time produces a fierce buildup of heat, especially when the components are packed as densely as they are in the newer Crays. Older models whooshed Freon through cooling channels to dissipate the heat, but so much thermal energy boils off the Cray-2 CPU that its engineers finally decided to dunk the whole unit permanently in a tank of pure liquid fluorocarbon, a clear fluid with the consistency of salad oil.

The original plans called for a 32-million-word memory and a CPU cycle time of 4 nanoseconds. Operation will be dramatically enhanced through multiprocessing—the Cray-2 will contain four separate central processors that will serve to carve complex tasks down to size.

## In the Trenches

A supercomputer is quicker than a PC for many reasons. The clock is faster—the X-MP is ready to do something new every 12.5 billionths of a second, and the Cray-2 will be three times speedier than that. Since the PC clock ticks once every 210 billionths of a second, it's 16 to 50 times slower right out of the blocks. In addition, the PC can shuttle only 8 bits of information from chip to chip at a time, while the Cray moves data over a 64-bit bus. There's another factor of eight.

The Cray has specialized hardware units within its CPU to handle various mathematical functions especially quickly. There are special dedicated circuits for vector and scalar addition, subtraction, shifting, logic handling, and multiplication; floating point addition, multiplication, and reciprocation; address addition, subtraction, and multiplication; and other operations. The PC's 8088 chip has almost none of these time-saving mechanisms, and usually ends up huffing and puffing its way through repetitive calculations to perform functions the Cray dispatches in a pass or two.

The Cray also boasts such speed-demon features as a pipelined CPU and interleaved memory. What this means is that special hardware queues up data so that new processing can be started virtually every time the clock ticks, while a large amount of other processing is still in progress. Its CPU can be starting a computation while it's a quarter of the way through a second calculation, halfway through a third, and just finishing a fourth. The PC lumbers through individual calculations one by one and often misses a cycle or two between them.

The Cray is also specially built to store and move vast buckets of data words at a time. But beyond all this, the Cray can handle true parallel processing and vector processing, which leaves the humble 8088 buried in its dust.

## Vector Magic

Computers can crunch two kinds of variables, scalars and vectors. A scalar is a single number—one constant in a formula or one element in an array. A vector is simply a series of numbers that can be operated on in similar ways. If, for instance, you wanted to increase the salary of every employee in a company by 10 percent, you could perform either scalar or vector operations. A scalar operation would find the first personnel record, calculate the additional salary, write the increased figure to a part of memory, loop back and get the second record, figure out the increase, write the new figure to memory, loop back for the third, and so on, until it exhausted the raw data.

A vector operation would load in all the salaries and zap the values all up by 1.1 virtually at once, without having to backtrack for each new record. One vector instruction would read in all the raw figures, the next instruction would perform all the multiplications, and the last would

Illustration: Produced by SEDIC, Mandala Images © 1983 Agama Publications, Tokyo, Japan

store all the new figures in the appropriate place.

However, while many programs can benefit from vector processing (such as those with lots of loops, matrixes, and arrays), many cannot. An IF-THEN can choke a vector processor momentarily in its tracks, so any computer with vector processing architecture must be able to handle scalar operations as well.

Early vector processors had other problems. It could take a long time by computer standards to set up the vector processing operation, which meant that long loops paid off in time savings but not shorter ones. If the vector was too short, the vector operation "start-up" time combined with the actual computation time ended up taking longer than it would have to perform scalar operations on the individual elements. And since the vector processor could inhale streams of data out of memory and try to slap back the new data virtually simultaneously, there was often an annoying memory logjam.

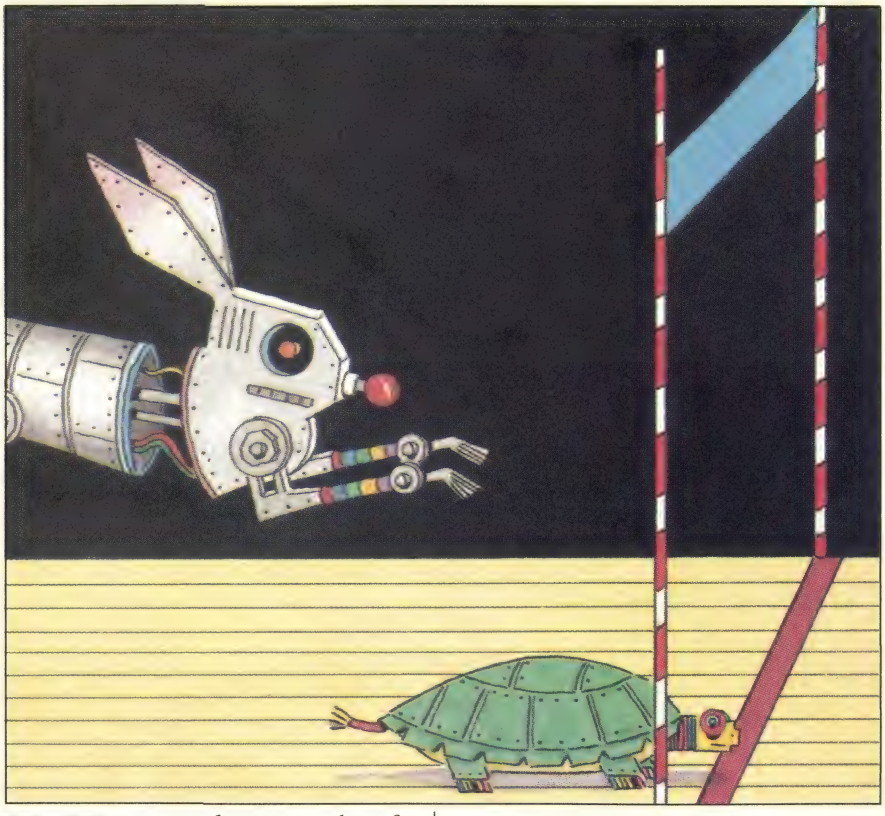
Sophisticated supercomputers like the Cray have separate registers and instructions for vectors and scalars. The start-up time for vector operations is so brief that vector processing pays off in time savings with as few as two elements. Special instructions juggle vector registers to avoid memory conflicts.

The memory itself is composed of banks of fast, power-hungry, bipolar chips. It has special circuitry to correct all single-bit errors and detect all double-bit errors. With a Cray, you don't have to worry that in the middle of an important job you'll look up in shock and see the bane of PC users—a frozen screen and a "Parity 1" error.

Instruction buffers in the Cray are unusually massive, allowing large chunks of instructions to be stored in one gulp. If an instruction branches forward or backward, its destination is often already loaded in the buffer and can be immediately executed. The PC buffers only four instructions. And because the Cray X-MP can handle such large words, when it has

## THE TORTOISE AND THE HARE

The Cray may be the fastest computer around, but after waiting all day for a few seconds of CPU time, you may long for a PC.



Many people assume that, for the purposes of scientific enquiry, the Cray is the best way to go. The Cray, which is accessed through a front-end mini or mainframe computer, can run through highly complex calculations very quickly. (In fact, the Cray is so sophisticated that the U.S. government prohibits the sale of the machine to Communist countries.) But, because of its reputation for speed and sophistication, Crays are popular, and therefore, expensive to use and difficult to access.

In order to use the Cray, researchers must (unless they are extraordinarily rich) rent time through a time-sharing service. The cost depends on how much of the machine's memory is used, how much I/O is required, and how quickly the computations are needed. Users must be patient since they may have to wait most of a day for their turn.

Until recently, it was assumed that the Cray was so much faster than any other machine that, even considering the lag time, it was still the best and fastest electronic resource for large number-crunch-

ing applications. However, an innovative oceanographer has found a way to get his work done without having to wait on the Cray access line. "If I get on the queue for the Cray," said Professor Ferren MacIntyre from his office at the University of Rhode Island, "it takes me all day to get through for a few seconds of CPU time. In 15 minutes I can run a similar program and get the results from my PC. Of course, the same program would take 3 weeks to run in BASIC."

MacIntyre works with the center for Atmospheric Chemistry at the university's Graduate School of Oceanography. Currently, MacIntyre's sea-bubble studies are funded by a grant from the National Science Foundation (NSF), which hopes that such research will contribute to an understanding of the global cycles of many natural elements—as well as artificial pollutants—that are continuously released by the ocean into the atmosphere.

He got the idea of comparing his PC's performance to that of a Cray when he started running a light-scattering program originally devised for use on the Cray. MacIntyre translated the program, written in FORTRAN by Warren Wiscombe at the National Center for Atmospheric Research in Boulder, Colorado, into MMSFORTH when he found he needed it for his work.

"It measures the light scattering from particles not much larger than the wavelength of light," he explained. "So you can't do it just with geometric optics. You have to use full electromagnetic equations. This program gives you two components of the polarization and the intensity of the function of angle clear across the spectrum.

"For example, there must be 15 or 20 different kinds of halos that appear around the moon. Because the particles that scatter the light are all different sizes, you have to integrate not only across the wavelength of light but also across the range of droplet sizes or ice crystal sizes. In my case," he said, referring to his work with ocean bubbles, "that means that each different sized bubble gives me different results.

"The thing about light-scattering programs," he continued, "is that they consume a lot of computer time. So what Wiscombe did was to sit down and try to speed up the original program as much as he could—and he did it to a factor of two over the next best program."

### Typical Hardware

MacIntyre uses a fairly typical hardware system: an IBM PC with 128K, two single-sided 195K disk drives, monochrome and color monitors, a printer, and a Hewlett-Packard 7478 plotter. In order to speed up operation, he added an 8087 math coprocessor chip. Coupled with MMSFORTH, a high performance, stack-oriented computer language, it transforms his PC into a viable scientific computer.

"The secret of speed using the 8087 chip is to keep all the intermediate values on its little stack. It's 80 bits wide, so it takes you ten fetches and stores to move things to it. But if you keep intermediate results on the 8087 stack, then you avoid the overhead of sending 10 bits out to memory."

Sophisticated supercomputers like the Cray have separate registers and instructions for vectors and scalars.

Once MacIntyre had translated the program into MMSFORTH, he began to wonder about its speed as compared to a Cray. "My feeling is that the PC is about 1,000 times slower than the Cray. Twenty of that is just in clock speed, since the clock on the Cray is 20 times faster than the clock on the IBM. Then there's word length—the Cray is 64 bits instead of 8, so you can do more in a single instruction on the Cray than you can on the PC."

He is planning to try a real test of the PC against the Cray sometime in the future. "Sooner or later, all these programs hit a numerical instability, and things just go to pieces. When my PC program hit an instability as the bubbles got larger, Warren Wiscombe assured me that this happens to everyone on all machines, sooner or later.

"In fact, Wiscombe has said he'd be glad to compare notes with me on the machines' performances. He would run his program on the Cray, and I would run mine on the PC, using the same input numbers. Then we would compare and see when each one begins to go bad."

Meanwhile, McIntyre is happy running his figures through MMSFORTH on his souped-up PC. "I've talked to the scientific and technical subsection of the IBM subsection of the New England Computer Society, and they are struggling with Fortran—and I mean *struggling*. I figure I'm 3 to 5 years ahead of them in what I can do with my machine.

"As far as I know," MacIntyre concluded, "this is the most complicated program that has been run on a micro."

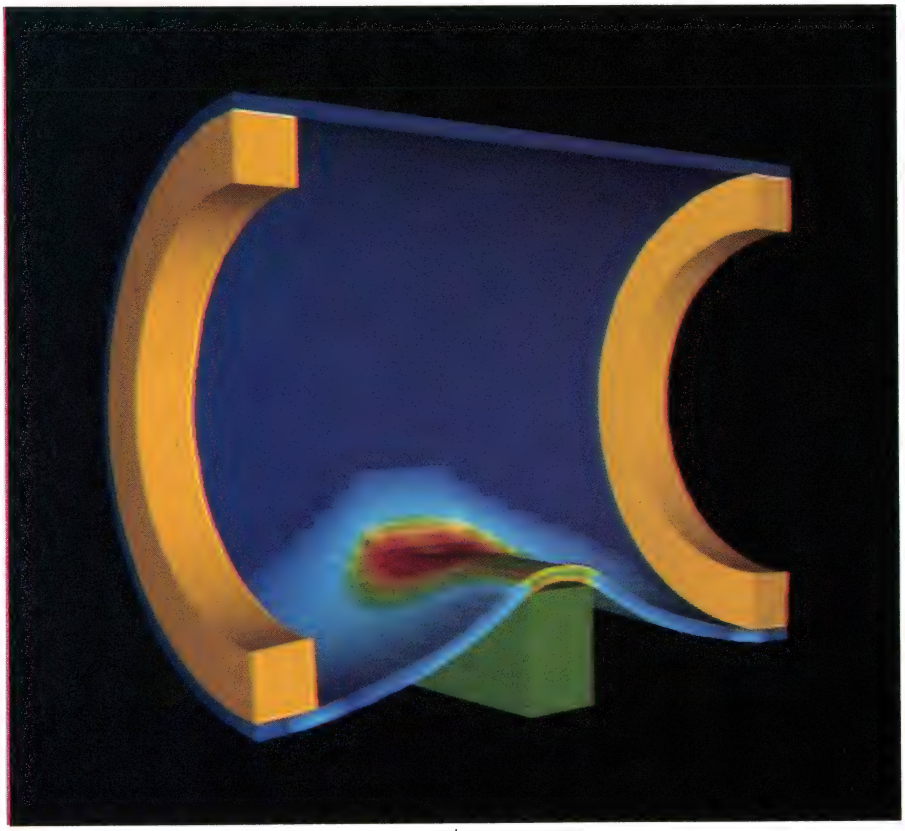
**—Todd Katz and Barbara Krasnoff**

Illustration: Kurt Vargo

to jump to a new instruction it can haul in 8 memory bytes per clock tick.

Vector instructions in the Cray benefit from register reservation and chaining. This means that register space is set up to anticipate the flow of data through each function unit and bounce the results of one calculation immediately into the next function unit. The vector doesn't stop flowing—each time an operation is performed on it, the new values are fed automatically into the next process in the chain. This is carefully orchestrated so that as much as possible is going on with every clock tick. The secret of ultra-fast processing is to keep the pipe filled.

The Cray can scorch your I/O lines with eight concurrent data streams to as many as 64 tape units (half of which can be churning away at any one time) as well as to forty-eight 600-megabyte disk drives. The drives can shovel bits back and forth over two 100-megabyte-per-second channels, and one high-speed conduit is capable of hurtling a billion and a quarter bytes per second in and out the door to the Cray solid state memory.



## CHIPpewa Falls Makes Good

Today's supercomputer is the brainchild of its eponymous founder, Seymour R. Cray, an eccentric's eccentric from Chippewa Falls, Wisconsin (Annie Hall's hometown). Cray, if you believe the public relations puffery, helped invent supercomputers and singlehandedly designed most of the early ones, first as a cofounder of Control Data Corporation (CDC) and later as his own favorite designer. One national business magazine recently labeled him "a national resource," albeit an unusual one.

Cray has garnered much attention for his quirky habit of designing sleek sailboats. He'd lay down the plans and build a new one by hand every year. He'd sail it all summer, and then—are you ready—burn the thing in the fall. This would spur him on to devise an especially yar craft the following season. "There's not much to designing," Cray is fond of saying. "I design computers about the same way I design sailboats—for simplicity."

Cray left CDC to start his own company in 1972. A swarm of trusting venture capitalists anted up $2.5 million in seed money. Cray hunkered down in an abandoned shoe factory to plan the construction of a "super-quiet think tank where we will develop a colossal giant computer." The offices were designed to be as acoustically dead as possible to eliminate distraction and encourage solitary creativity.

The company's singular mission was to develop what Cray called the "next generation of supercomputers." He carefully restricted development efforts, since giving in to the temptation to create mainframes designed for a mass market would force his fledgling company to go elbow-to-elbow with such industry giants as IBM, NCR, Control Data, and Sperry. Instead, Cray insisted on carving out his own small but growing niche.

Development was parsed out to small teams of engineers, each responsible for specific tasks and safely removed from the drudgery of daily company management. Cray asked his developers for major performance leaps that would change the nature of computing. "The person using the equipment is striving to do something significant," he said. "I contribute to it by providing a tool. If I were just building something a little cheaper and a little more cost-effective, I wouldn't get the satisfaction I do out of doing something more dramatic."

One of the problems in building such a sophisticated machine is that the number of potential buyers is small. Cray initially identified fewer than 100 whose simulation and modeling needs warranted the expense of buying the machine. The sophisticated requirements of these potential customers dictated the original specs. Cray's computer had to contain a million words of 50-nanosecond memory. The system clock had to run at 12.5 nanoseconds. The entire unit was eventually housed in a box 6 feet high and 4 feet in diame-

ter, knitted together with 60 miles of wires.

As the first Cray-1 neared completion in 1975, the $8.6 million Cray Research had raised since its inception was nearly gone. Cray dispatched chief financial officer John Rollwagen to New York to raise $10 million more with a new stock offering. While the company had never sold a single unit or generated a cent of revenue, eager investors snapped up every share. The following year Cray delivered his first working system to Los Alamos National Laboratories and signed up the National Center for Atmospheric Research as its next customer.

## A Better Mousetrap

At this point, the production goal was one system per year. Cray began development of the next generation supercomputer in 1977 and upped the annual production to four, and then to eight in 1978. At the same time, he expanded the company's production of applications software that would run under his proprietary COS (Cray Operating System).

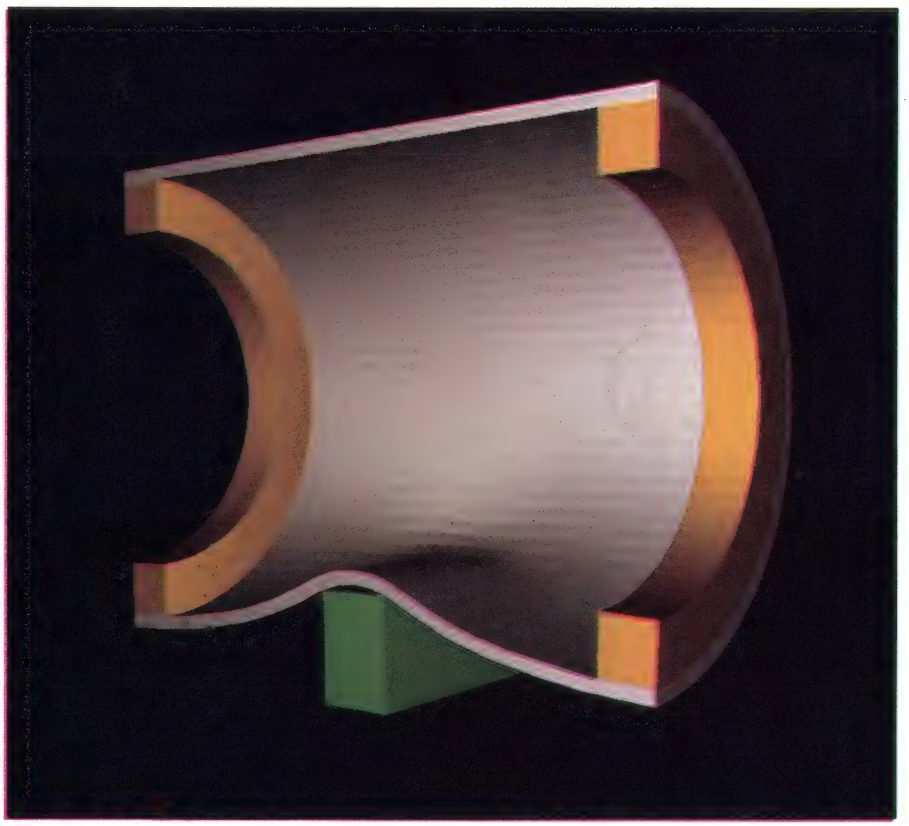
In 1979, Cray Research announced the Cray-1/S, a version with more memory and enhanced I/O capability. The company had grown from 30 employees in 1974 to over 500. Its profit that year equalled the total capitalization of the 4 years since founding. Cray resisted the temptation to produce less powerful hardware for a larger market, on the theory that "growing numbers of industrial and scientific researchers would require the computing capability available with the Cray-1," especially now that there was a swelling base of satisfied users.

In 1980, Cray Research shares traded on the New York Stock Exchange for the first time. By 1981, 35 systems had been installed, and there were over a thousand employees on the payroll. Cray released the X-MP specs, and announced the Cray-2, an awesome hunk of hardware 6 to 12 times as powerful as its predecessor and half its physical size—a machine that pushes silicon to its technological wall.

In the first 7 years of business, Cray's company sold a total of 60 machines. Various government agencies walked away with half of these; the rest were divided among wealthy universities and businesses. According to recent reports, its entire universe of potential customers amounts to 50 active prospects, although four or five times that number of universities and industries are catching the fever and thinking about taking the plunge. While the company is not exactly rolling in dough, it is making money. *Forbes* reported that in 1982 Cray Research rang up a $19 million net on $141 million of sales, and estimated 1983 sales at $170 million.

Seymour Cray has passed the reins of the company he founded to John Rollwagen and is now under contract as a consultant. His main interest these days is developing a new generation of computer chips with gallium arsenide (GaAs) substrates rather than conventional silicon. Electronics engineers are wringing the last bits of performance out of silicon—there is a the-

There is much emphasis at Cray Research on style, and little of the rock-ribbed stuffiness that characterizes some large computer producers.



Illustrations: J.O. Hallquist, Lawrence Livermore National Laboratory

oretical limit to how tiny you can make the traces and devices on a chip. But by putting these devices on gallium arsenide compounds in the same densities, you can kick up performance by a factor of five.

There is much emphasis at Cray Research on style, and little of the rock-ribbed stuffiness that characterizes some large computer producers. This attitude can be attributed in part to the free-wheeling image of the company's founder. Rollwagen sums it up this way: "We take what we do very seriously, but don't take ourselves very seriously. Economy comes from high value, not low cost. Aesthetics are part of quality. The Cray approach is informal and non-bureaucratic. Verbal communication is the key, not memos. 'Call, don't write' is the watchword. People have fun working at Cray Research. There is laughing in the halls. With informality, however, there is also a sense of confidence. Cray people feel they are on the winning side. It is this sense of confidence that generates the attitude of 'go ahead and try it, we'll make it work.' "

### Cray Best Sellers

Cray's catalog of applications software doesn't boast any spreadsheets or games. But you can pick up a helpful package if you plan to noodle around with a simulation of launch and upending characteristics of large offshore structures; static, dynamic, and thermal analysis of 3-D piping systems; reactor transient analysis; molecular structure simulation; MOS transistor design; eigenvalues and eigenfunctions; 2-D partial differential equations; or the ever-popular transonic fluid flow simulation. Cray also offers a text processor called ROFF.

Crays are immensely popular with oil companies. Locating new oilfields involves processing hundreds of millions of facts, such as complex data from seismic studies and evaluations of satellite photographs. And once a promising field is located, there are many ways to extract the oil. Mathematical models can tell an engineer which extraction technique will maximize recovery over time. The stakes are so high and oil companies so wealthy that they want the most powerful computers on the market, hang the expense. Arco's Cray-1 paid for itself in one simulation by squeezing an extra 7 percent out of a 20-billion-barrel oil field.

### Mersenne Primes

Crays are also frequently used for pure mathematics calculations. The 27th, 28th, and 29th Mersenne prime numbers were discovered on a Cray, using a complex formula chockablock with Greek letters and odd signs that is not included here as it would give the typesetter apoplexy. A Mersenne prime is an integer of the form 2^P-1 where P is a prime number. The first few are 3, 5, 7, 13, 17, and 19, and were nailed down by Father Marin Mersenne in 1644. Why, no one knows. Their singular property seems useful only in testing computational ability and getting press attention. Mathematics luminaries Fermat and Euler were obsessed with this arcane area. So was someone at Black Rock: When the 25th Mersenne prime was discovered, Walter Cronkite announced it on the CBS Evening News.

The 27th, 28th, and 29th Mersenne prime numbers were discovered on a Cray, using a complex formula chockablock with Greek letters and odd signs.

By 1963, various computer operators had listed the first 23 of these. In 1979, Cray employee David Slowinski, "with hopes of being mentioned in *Time* magazine," set out to unearth the world's largest prime number on a Cray-1 undergoing a factory checkout, which could handle the necessary 75 million 48-bit-precision integer load-multiply-shift-adds per second without batting an eyelash. Slowinski was using his own implementation of an algorithm called the Lucas-Lehmer test. A similar computer run to locate 2^8191-1 took 100 hours on Illiac-I (in the ancient history days of 1959), 5.2 hours on an IBM 7090, 49 minutes on Illiac-II, 3.17 minutes on an IBM 360/91, and 10 seconds on the Cray.

Slowinski verified the 26th Mersenne prime just 2 weeks after it had been announced by rival searcher Curt Noll. It had taken Noll 8 hours and 40 minutes on a CDC CYBER-174 supercomputer (designed by —who else?—Seymour Cray). Slowinski's search on the Cray took less than 7 minutes. But the Eberhart conjecture predicted that the search for the 27th would take 2,000 hours of Cray time (an expensive proposition even at the 1979 rate of $7,500 per hour.) Undaunted, Slowinski was able to incorporate a number of shortcuts into his search and stumbled onto the number after testing a mere thousand unwieldy integers.

The 27th prime, 2^44497 -1, is a 13,395-digit whopper, but it's small potatoes next to its big brother, Mersenne prime 28. A Cray knocked off that one too, after a trifling 600-hour hunt. Slowinski was in on the new discovery as well, having streamlined the search algorithm by 40 percent over its slow-footed ancestor through optimization of the number-squaring procedure. According to Slowinski, nine-tenths of the computer's time is spent squaring 25,000-digit numbers, a task made especially fearsome when I realize I have trouble at my local market



comparing the relative price of two cans of tomato soup.

Slowinski thinks he has found the 29th. It is a 39,751-digit behemoth (2^132049 -1) so unwieldy it is taking a long time just to verify.

Others have found more practical applications for their Crays.

## Computers for Art's Sake

Boeing estimated that a computationally derived improvement in the aerodynamic efficiency of a 747 jet would result in annual fuel savings of $75,000 per aircraft. Experts peg the potential improvement in efficiency on aircraft designed on top computers rather than through conventional engineering techniques at 10 to 20 percent. To handle the intricate aerodynamic equations required for this kind of saving, half a million separate points on the aircraft must be computed for a workable 3-D representation. Boeing credits its Cray with the feat of increasing the aerodynamic efficiency of part of its new 767 jet by an astonishing 12 percent.

Digital Productions is a Hollywood-based film and production studio "devoted to the advancement of state-of-the-art computer graphics imaging and animation." The goal at Digital Productions is to produce computer graphics that audiences can't distinguish from live action scenes. Digital owns a Cray-1/S and was the first company to order a Cray X-MP.

The 1/S can calculate the needed million polygons per 4,000 × 6,000 pixel frame. The rule of thumb is that animation requires ten calculations per pixel per frame. At the commercial film speed of 24 frames per second, it will take 5.76 billion calculations to produce 1 second of film. But since complex animation can require as many as 1,000 calculations per pixel, it can take over half a trillion arithmetic instructions to yield a second of top-quality film. Fortunately, not every pixel changes each frame of the film, and many pixel calculating operations can be performed with relative ease.

The company's trademarked graphics rendering system, Digital Scene Simulation, takes into account such factors in every frame as perspective, highlighting, shadowing, surface texture, microfaceting, reflection, the effect of multiple light sources, volumetric transparency, translucency, and refraction. And these are just for stationary objects. To simulate true realism, a computer must juggle the dynamic interaction of motion, expression, gravity, friction, and the other physical effects of nature.

For instance, we don't really see things the way they are. The focus of our vision is extremely tight. If you look at a book on a shelf across the room, you may notice that you can focus on one word of its title at a time. The other words in the title look fairly crisp and sharp, but this is an illusion. If you really concentrate on keeping your focus fixed in one place, you'll see that surrounding books are not really in very sharp focus and that things at the edge of the room are actually just blurs. They

Illustration: Peter Watterberg, New Mexico

don't appear blurred because your eye can dart to any other object in the room and focus on it in a fraction of a second, and because we're accustomed to seeing things blurred—our minds know what a lamp looks like and translate the blurred image at the periphery of our perception into a sharp, crisp image in our brain.

Similarly, if you move your hand back and forth in front of your face, what you'll really see is a flesh-colored smear with the wall behind it peeking through. This phenomenon plagues computer graphics designers, since it's hard enough to create the image of a hand moving or of a natural-looking room. Observers can usually spot computer animations because they're *too* good. The moving hand looks too strangely perfect; the whole room looks too sharp and crisp. We use depth of field cues to orient ourselves; if we're looking intently at the back wall, something right before our eyes can't also be in focus and vice versa. A good computer animation has to constantly monitor what object on the screen should be receiving our attention and then progressively cover the other elements in front and back of it with layers of visual gauze.

This is such a laborious process that on Digital Productions' original Cray 1/S, at the quarter-million polygon complexity level, a total of 4 minutes of film was generated each month. The total annual production of 45 minutes of animation was expected to increase 400 percent with the arrival of the X-MP.

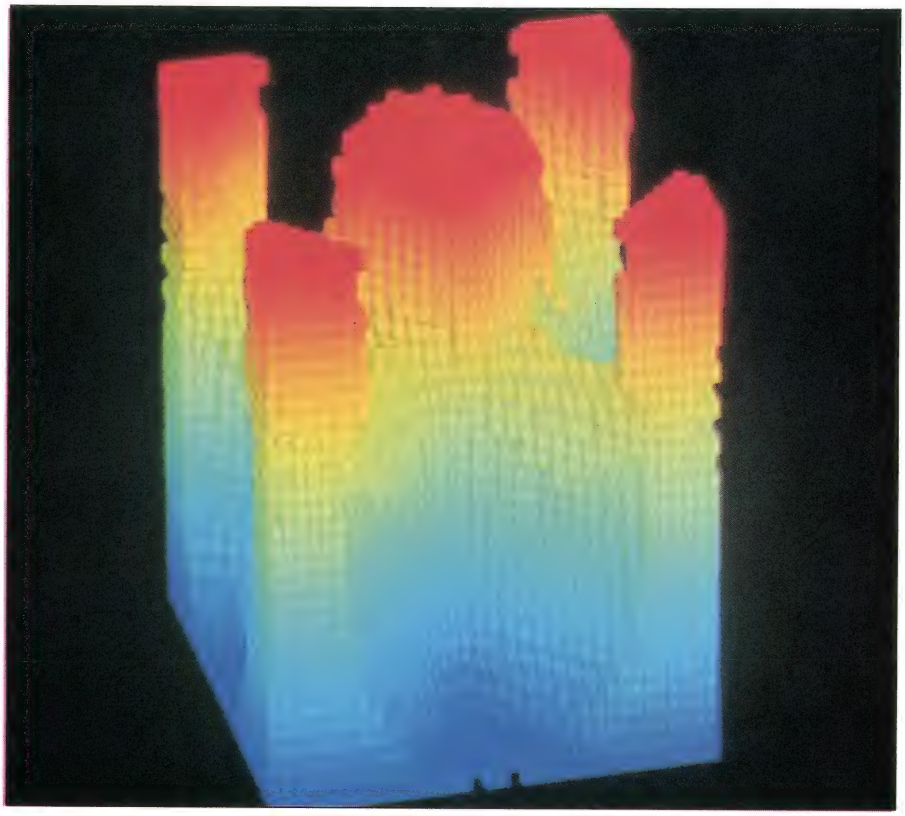
One outside graphics artist who moved from a less powerful system to a Cray discovered (much to his dismay) an additional feature of supercomputers—super accuracy. When the artist ran his program on the Cray after running it on the smaller computer, he was astonished at the drawing speed but befuddled by certain distortions in the image. This turned out to be the result of the Cray's penchant for precision. The mini on which the program had been developed had rounded off floating point numbers far more crudely than the Cray, and the error was multiplied by the reiterative looping common in most programs.

While no micro can touch the performance of a supercomputer, some enterprising technicians have successfully networked micros together into a primitive parallel processor.

### National Laboratories

In 1978, Lawrence Livermore National Laboratory installed a Cray-1. It now has a total of six Crays systems. Scientists there have calculated that one of their Cray-1 computers has 22,200 times the power of the lab's original Univac 1. The Crays are used both for classified weapons research and for such nonmilitary applications as analytic cytology and the development of controlled fusion reactors.

Los Alamos National Laboratory owns five Crays linked together in one massive system. Its engineers actually built one of the very primitive supercomputers, MANIAC (the Mathematical Analyzer, Numerical Integrator, and Computer) in 1952. Its successor, the University of Pennsylvania's fabled ENIAC (Electronic Numerical Integrator and Calculator) was a monstrous concatenation of 18,000 electron tubes and half a million solder joints.



Los Alamos later purchased innovative IBM systems such as the 701 and STRETCH, and eventually turned to two systems Seymour Cray designed while working for Control Data Corporation, the CDC 6600 and 7600.

Today, more Crays are installed under one roof at Los Alamos than at any other facility, and four older CDC machines designed by Seymour Cray are there as well. Seventy percent of all the Los Alamos computing programs are for "national security" projects. The laboratory owns several printers that can churn out 10,000 lines per minute. Five thousand networked users produce up to 3 million pages of print and microfiche monthly. The common file system holds 13 trillion bits of data, yet the average disk response time is a mere 5 seconds. A typical job can require 70 Cray CPU hours.

The laboratory was the site of a telephone-line break-in by the notorious Milwaukee 414s late in 1983. The teenaged intruders managed to tap into one of the small VAX computers in the unclassified partition of the three-partition network. Officials were not amused and sicked the FBI on them.

## Cray vs. Micros

One Cray analyst, spurred by the request of his son's teacher to address the class on computers, compared the performance of a Cray-1 S/2400 to that of a TRS-80 in multiplying a 50 × 50 matrix. The TRS-80 stumbled through the calculation in 3,180 seconds, while the Cray popped it off in .002 of a second. However, his son's TRS-80 cost $999 and the particular Cray model a hefty $7,620,000, so the performance ratio was 1/1,590,000 while the cost ratio was a closer 1/7628.

While the TRS-80 computer was not built to do matrix multiplication, the Cray analyst dryly observed that to have equivalent price/performance ratios, either the Cray-1/S should cost 200 times more than it does or the TRS-80 should cost 200 times less.

| HARDWARE | SOFTWARE | TIME (in seconds) |
|---|---|---|
| Cray | FORTRAN | :00.001 |
| VAX 11/780 | FORTRAN | :03 |
| HP 9000 | FORTRAN | :08 |
| Apollo | FORTRAN | :59 |
| Symbolics | FORTRAN | 1:23 |
| Sun | FORTRAN | 1:30 |
| BIT LSI-11/23 | FORTRAN | 2:00 |
| IBM PC | QNX C (with 8087) | 1:15 |
| IBM PC | Supersoft FORTRAN (with 8087) | 5:10 |
| IBM PC | Supersoft FORTRAN (no 8087) | 8:20 |
| IBM PC | C 86 | 28:12 |
| IBM PC | Lattice C | 29:12 |
| IBM PC | IBM/Microsoft FORTRAN | 224:00 |

**Figure 1:** *The results of a study done by Lawrence Livermore Laboratories comparing speeds of a range of computers.*

## Cray vs. the IBM PC

Cray benchmark expert Mike Ess is often asked, "If everyone in the United States had an IBM PC, would we still need supercomputers like the Cray?" The answer is an obvious yes. The PC is just too small to solve large problems such as oil field simulations or space shuttle reentry turbulence models. And it is painfully slow. How slow? Ess points to a study done by Lawrence Livermore National Laboratory (see Figure 1). All the machines in the study ran the same program on a hydrodynamic mesh code called JELLO, with a mesh size of 5 for 1,000 iterations and with codes as similar to each other as possible. Timings were crude and the longer PC runs were timed with a stopwatch rather than by the software.

While Ess is pleased that the Cray is so fast, he cautions us not to attach too much value to the results: "Conclusions about machines shouldn't be based upon one application, on one program, and one set of data." With this in mind, he adds that he can't resist extrapolating that 1 Cray second is equal to .87 days of IBM PC time with the best software or 155.5 days of IBM PC time with the worst software!

While no micro can touch the performance of a fire-breathing supercomputer, some enterprising technicians have successfully networked micros together into a primitive parallel processor. A Japanese attendee at a recent Siggraph convention claims to have networked 64 micros together to yield performance close to that of the top dedicated graphics workstations.

## Semiconductor Advances

Cray is working with a subsidiary of the Harris Corporation on a joint project involving supercomputer chips made of gallium arsenide. Cray's Rollwagen admits that the days of strictly silicon-based supercomputers are numbered: "The speed limitations of silicon are now being reached. The trend there is for greater den-

Illustration: T. Yabe, Institute of Lazer Engineering, Osaka, Japan

sities without significant changes in speed. Consequently, newer technologies, like gallium arsenide, are being explored. GaAs seems to be the technology of the future as far as speed goes, but it will be coupled with other technologies as well, such as CMOS.''

Dr. Richard Soshea, a vice-president of Harris, agrees: ''GaAs integrated circuits can operate at speeds up to five times those of silicon-based equivalents. This advantage is being increasingly recognized in the design of microwave and high-speed signal processing systems. GaAs technology is now sufficiently well-established to encourage its application in very high speed computer systems like Cray products.''

Some scientists at Cray Research say that gallium arsenide will be to computing in the 1980s what silicon was to the industry in the late 1950s and early 1960s. Gallium arsenide beats silicon hands down in several key areas. According to Cray senior design engineer Phil Gerskovich, the most important considerations in choosing materials for integrated circuits are electron mobility and insulation. ''The electron mobility of GaAs is about four to five times faster than that of silicon. Not only that, but these electrons can be moved at high speeds and at lower voltages than silicon. That factor is very important in designing supercomputers that demand tremendous amounts of energy.'' And gallium arsenide's insulating properties are desirable since no special insulating designs are required (as they are with silicon) and since switching time is faster.

### Chips of the Future

Gallium arsenide does have problems. A GaAs wafer now sells for around $300, compared to $6 for silicon. But researchers point out that much of the final chip cost is tied up in processing rather than raw materials. GaAs is also fairly brittle, but special precautions can compensate for this. There are a host of other nagging issues. Ions, when accelerated, can tear

## THE ORIGIN OF PCS (AND THE DESCENT OF CRAY)

The Cray and the PC are silicon cousins in the same evolutionary line. They may also share a future.



At first glance, the PC and the Cray, desktop magician and supercomputer sorcerer, have little in common. In fact, though, the little fellow and the mighty Cray share a common history and quite possibly a common future.

Both machines are the offspring of the ancient giants that were handbuilt in university basements and military garages during the early years of computing. Clattering, house-sized behemoths stuffed with vacuum tubes, these prototypes were far bigger than today's Cray while less powerful than the PC. From them flowed two streams of computer development, each culminating in the PC and Cray, respectively, and each in its own fashion pointing the way to computing's future.

The technological current that led to the Cray emphasized the values of speed and power. At the headwaters of this current were the ENIAC and UNIVAC—in their time, the most powerful computing machines in the world. During the 1950s and succeeding decades, the best minds in computing struggled to make ma-

chines that were even faster and more powerful, even more awesome in overall capabilities than their mighty predecessors. This lineage led to successive generations of mainframe computers, then supercomputers, culminating in the incredibly potent Crays, which seem in a position to dominate computing's high-end for the next generation.

The PC path began at the same source but headed in a different direction. ENIAC and UNIVAC, though computer dinosaurs, were also the most convenient and practical computers of their time. The realm of microcomputing was discovered as successive waves of computer designers attempted to create machines that could do at least as much as—and, it was hoped, much more than—the vintage 1945–1951 models in more convenient ways, in easier-to-use shapes, and with friendlier systems and more-flexible hardware. The result of this stream of innovation and personalization is the PC, a human-size machine that balances power and convenience.

## Computer Evolution

The PC and Cray are clear illustrations of how in the world of technology, as in biology, different environments can produce great variations in the descendants of one family. But there is one great difference between technological evolution and its biological counterpart; namely, in technology, disparate relatives are not separated for all time. They can evolve toward one another and converge, as is the case with the PC and its cousin, the Cray.

In a very real sense, when you look at today's Cray supercomputer, you are looking at the capabilities of the PC of 2019. The computing power of the old ENIAC now fits on a chip half the size of a contact lens. In a new generation, PCs will be chip size and the machine that sits on your desk will easily do what only a monster supercomputer can accomplish right now. "One good way to assess future trends is to compare a current supermini with what might be available in the size of a PC in 10 years," says Michael Ess of Cray. "One excellent supermini can now be bought for about $500,000 with a million words (8 gigabytes) in storage and a 64-bit word length. In 10 years, that machine will fit onto a chip."

Ten years beyond that, in the year 2004, a current mainframe could easily shrink to chip size. In the even more distant future, Michael Ess describes "a very good and likely scenario" in which incredibly powerful PCs—with capabilities far beyond those of today's mainframes—work in tandem with supercomputers in computer networks of such blinding speed and capacity that nothing done today can truly describe them.

## Von Neumann's Bottleneck

At the supercomputer end of the scale, development will not be as fast as with desktop PCs. At current speeds, supercomputers are beginning to bump up against the limitations imposed by the laws of physics. Since their signals can move no faster than the speed of light, their components must get closer and closer together and their switches faster and faster to speed them up. Supercomputers have already become so swift that only esoteric designs and switches based on peculiarities in physics can possibly improve their speed. In addition, supercomputers must overcome a theoretical barrier—the von Neumann bottleneck. Mathematician John von Neumann established most of the rules by which modern computers operate. One of those rules decreed that only one operation can happen in a computer at any one instant. Operations can follow incredibly quickly one after another, but they can't gang up. Future supercomputers are going to have to ignore von Neumann's ideas and create entirely new methods of processing data in huge, simultaneous chunks. Crays already do this to some extent, but in order to speed up new supercomputers, designers will have to abandon von Neumann and his computer ground rules.

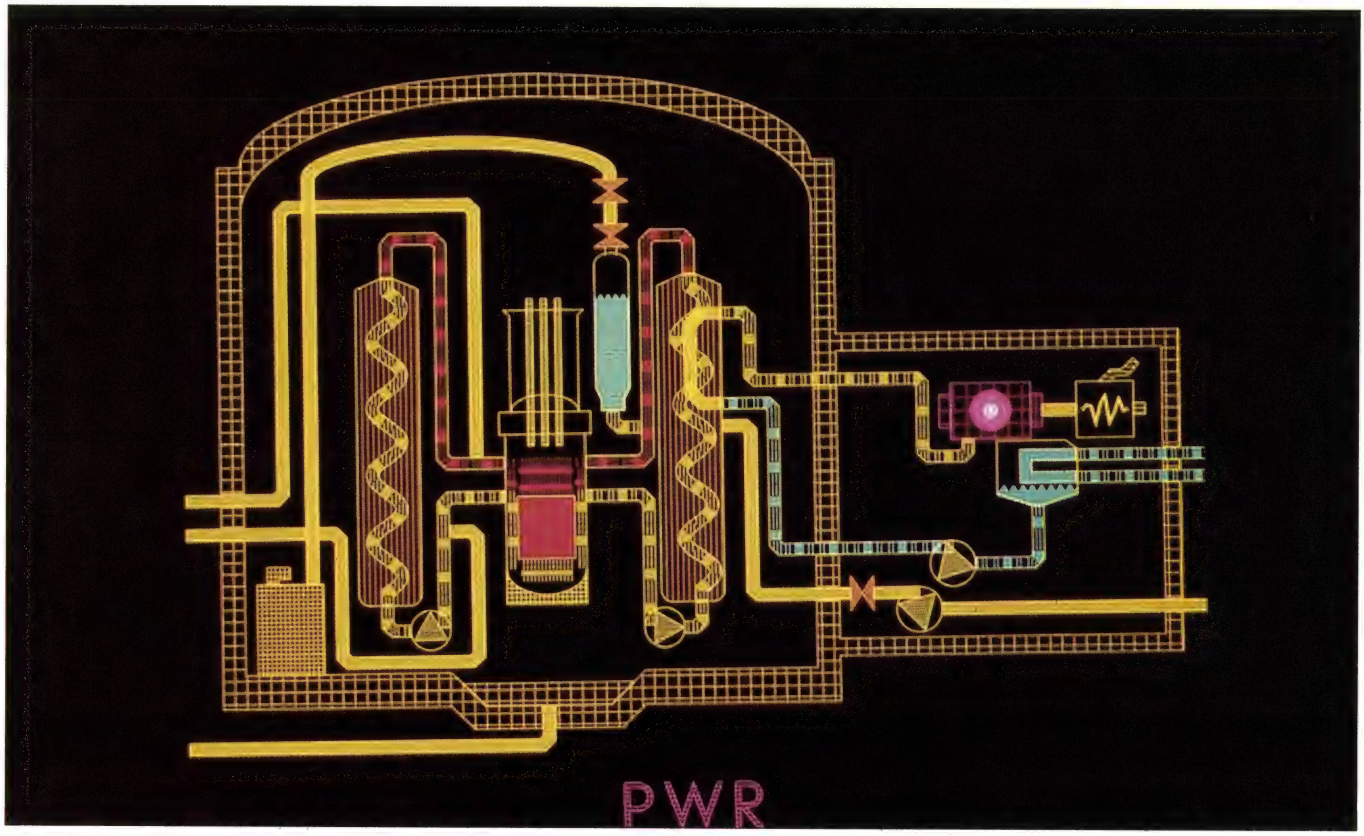
All this means that small computers are well on their way to catching up with their more powerful supercomputer relatives. The two branches of the computer's genealogy, having diverged from a common past, are converging toward a common future. That is the principal reason why the Cray can be a subject of fascinating speculation for PC owners today.—**Richard Basil**

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*Richard Basil is a corporate consultant in the fields of marketing and communications. He is also a published author and freelance writer.*

The PC and Cray are clear illustrations of how, in the world of technology, as in biology, different environments can produce great variations in the descendants of one family.

Illustration: Kurt Vargo




into the chip and damage the underlying wafer. Silicon chips are easier to repair. But Cray engineers—and many engineers in Japan—feel GaAs will indeed be the semiconductor of choice in the decade ahead.

Future chips must not only be faster but must work under more demanding temperature conditions and under a wider range of voltages. A promising area of research in this direction is with strained-layer superlattices (SLS), a new class of material made up of alternating layers of crystals grown so thin that 5,000 strata barely equal the thickness of a sheet of ordinary paper.

SLS semiconductors are exceptionally flexible, since each layer can be grown independently of its neighbor. Contemporary chip performance is degraded by imperfections between adjacent layers. But careful control over the elastic strain of each SLS layer during crystal growth results in a far more perfect atomic alignment than is possible with any of the conventional techniques.

Sandia National Laboratories, a leader in SLS materials, is growing these new crystals via molecular beam epitaxy (MBE) and metal organic chemical vapor deposition (MOCVD), two processes not commonly used in traditional chip manufacture. The only SLS devices that have been produced to date are simple diodes, but, according to Sandia researcher John Galt, strained-layer superlattices appear to be a major advance in semiconductor device science.

Other new techniques are promising revolutionary increases in the speed and flexibility of chip fabrication. Lawrence Livermore National Laboratory is now using what it calls "laser pantography" to paint circuits directly on blank semiconductor wafers. Green laser light a billion times more intense than noontime sunlight is pulsed through clouds of gas onto targets a single micron in diameter. This process is fast and reversible. Laser pantography can reduce the time it takes to fabricate a new chip from weeks to hours, a real boon for experimenters.

## Japanese Inroads

Hitachi and Fujitsu have announced supercomputers that rival the X-MP. The *New York Times* recently called the new generation of Japanese machines "clearly superior" in many respects, citing the ease of programming and the high degree of compatibility with existing American business computers. The *Times* warned that Hitachi and Fujitsu have "effectively ended the monopoly in high-performance computing held by the United States since the dawn of the computer era."

In 1982, the Japanese Ministry of International Trade and Industry launched an ambitious program called the National Superspeed Computer Project with the express goal of producing, by the end of this decade, a supercomputer a hundred to a thousand times more powerful than the current crop of supercomputers. Another government-sponsored program, the Na-

tional Fifth Generation Computer Project, hopes to develop a supercomputer with a high degree of artificial intelligence by the middle of the next decade. Such a machine would presumably be able to understand human speech commands.

In response, a consortium of United States computer manufacturers formed the Microelectronics and Computer Technology Corporation to thwart the transfer of computer primacy eastward. And 13 United States chip manufacturers pooled resources to start The Semiconductor Research Corporation, which they hope will "assure long-term survival in the market," according to director Larry Sumney (read "long-term *American* survival"). The Pentagon's Defense Advanced Research Projects Agency (DARPA) is now working on plans for its supercomputer-level "Strategic Computing and Survivability" project, but it has targeted this research toward the creation of smarter weaponry. Congress has committed a paltry $20 million annually for peacetime studies.

Fujitsu and Hitachi projected deliveries to approximately 30 domestic customers in the first 18 months, more new customers than Cray Research expects worldwide.

## Nobel Criticism

Many American scientists criticize such domestic programs as utterly unsubstantial. Dr. Kenneth G. Wilson, Cornell University Nobel laureate, sees grave consequences in the Japanese invasion: "They're clearly thinking about the IBM market. If the Japanese have really achieved IBM compatibility and can manufacture large numbers of these machines, they will compete seriously with IBM, with serious results for the United States."

Dr. Wilson is an ardent critic of the federal government's lack of support in this area. "The Administration's financial support figure is absurdly small, so it's really up to Congress to set a realistic figure. We need whole new families of supercomputers. The outcome will affect the entire United States industrial base. The issue hanging in the balance right now is whether American computer manufacturers are going to meet that need or leave it up to someone else."

Few American researchers have had a chance to use these new Japanese supercomputers, but those who have speak glowingly about them. Dr. Steven A. Orszag, a scientist at the Massachusetts Institute of Technology, had nothing but praise for what is shaping up as the most impressive new entry, the Fujitsu VP-200: "Fujitsu has taken the best features of Cray, CDC, and IBM architectures and put them all together. What is revolutionary is that these fast Japanese machines could be used by business or government. In the past, the uses of supercomputers have been much more specialized and mainly scientific."

In fact, Orszag feels the Japanese supercomputers surpass their American cousins in two important areas. The first surprise is that the VP-200 can use standard off-the-shelf software rather than expensive applications packages custom written for particular machines and needs. Even more astonishing to him, however, is that the VP-200 seems to be software-compatible with IBM.

Orszag derives two messages from this: "First, the machines are accessible to people who don't know much about computers. Second, the programs are portable and can be moved from computer to computer. That's important because software development today represents up to 90 percent of the cost of using a supercomputer. The Japanese advances will bring down costs dramatically. One doesn't care so much about small differences in speed; what's important is ease of use. We didn't realize until a very short time ago what an effort the Japanese had made on this point."

## Congress Talks

In 1983, the U.S. House of Representatives held hearings to investigate the current and future state of computing in this country and abroad. In the hearing charter, the government worried out loud that "Japanese industry and government have designed two cooperative research and development programs that are intended to result in a 100-fold improvement in large-scale computer performance" and that they threatened to "dominate the international markets for mainframe computers within 20 years."

In his testimony before the subcommittee, Cray's executive vice president John Carlson raised the spectre of Japanese domination of the market: "The world is on the verge of a major computing revolution as supercomputing is applied across a broad industrial and scientific base. The only question at this juncture concerns which nations will choose to lead this revolution.

"Many have questioned why the Japanese would enter supercomputing since their normal strategy is to target industries with broad commercial significance. While it is possible that the venture into supercomputing has been more for prestige, I believe that history will record the venture as a shrewd one. When Fujitsu and Hitachi announced their supercomputers last year, they projected deliveries to approximately 30 domestic customers in the first 18 months, or more new custom-

Illustration: Ray Elliot, Los Alamos National Laboratory

ers than Cray Research expects worldwide during the same period.

"The importance of leadership in supercomputing technology goes far beyond already well-established links to defense and national security. Leadership in supercomputing technologies, and in the aggressive implementation of that technology, could play a significant role in the future of both our basic industries and new technology frontiers.

"The record of the last five years indicates that in environments other than the Department of Energy laboratories, the U.S. research and engineering community has been slow to implement supercomputing technology. Even the defense and aerospace communities, which have in the past aggressively applied new computers, have lagged seriously behind their counterparts overseas."

Robert Cooper, director of DARPA, sees someone else in the woodpile and is on the record as wanting faster and more intelligent supercomputers to "hold off the Soviet threat." DARPA spends well over half a billion dollars annually on projects to develop "intelligent" weaponry systems.

Echoing Cooper's concern is Dr. Robert L. McCrory, director of the University of Rochester's Laboratory for Laser Energetics, who reminds the scientific community, "Until now no one challenged us. Supercomputers are strategically important. We've always had an edge over the Soviet Union in this regard." What bothers many experts is that a superior Japanese product could mean not only the loss of an important market for American products, but a growing dependence on foreign manufacturers for high-speed computers and components critical to national security.

If you want proof of this last point, look at a partial list of Cray clients: Lawrence Livermore, Sandia, and Los Alamos National Laboratories; the U.S. Air Force Weapons Laboratory; the Magnetic Fusion Laboratory; NASA; the UK Royal Armament Development and Research Establishment; Lockheed Missiles & Space Co.; as well as similar institutions in France, Sweden, and West Germany. The master roster of users also includes several listed simply as "Classified."

We've reached the point at which true advances in circuit design will be proposed, tested, and verified by computers themselves.

## The PC Connection

While supercomputers aren't directly influencing the way PC owners process text or chart the profits of their company, technological advances will benefit all computer users. The effects of faster, cheaper, smaller semiconductors and supercomputers ripple quickly downward.

Years ago it was laughable to think that so many people would have the power of a room-sized computer on their desktops, yet advances in chip design and fabrication have made this commonplace. As financial and nationalistic pressures drive innovation of computer design with increasing urgency, and prod worldwide competition, we may soon see affordable hardware that packs a far bigger wallop than anyone can imagine today.

Spurred by government efforts to keep the cutting edge of computer technology on these shores, this nation's scientific community may yet hammer together a tiny, astonishingly fast and powerful computer with enough intelligence to appeal to agrestic yahoos who today wouldn't even be able to figure out how to plug in a PC. But don't count your chickens yet.

Cray Chairman John Rollwagen, speaking at a recent conference on the frontiers of supercomputing held at Los Alamos National Laboratory, said he felt true intelligent computers would not be feasible for several decades: "Today's computers are left-brain machines. A right-brain oriented computer is far beyond where we are today. Using supercomputers is much harder than making them. There is always a time lag between the introduction of new high-powered hardware and the development of software that takes advantage of it." This is where the Japanese are said to be the weakest, and where many say they will falter.

Others disagree, and compare these complacent industrialists and politicians to battleships bobbing in the unsuspecting waters of Pearl Harbor. Supercomputers are becoming increasingly critical in our economy; they're already the mainstays of the armament, meteorology, oil and mineral exploration, cryptoanalysis, and aircraft worlds. They're rapidly chiseling out footholds in the automobile and shipbuilding industries, and in such research areas as genetics and medicine. And one of their most promising uses is in designing circuits for better, faster, more powerful computers. True advances in circuit design will be proposed, tested, and verified by computers themselves. The nation whose computers are better able to refine chip design will end up with better computers that will in turn be able to refine chips better, in a tightening loop—or noose.

The Cray X-MP is just another computer. While the idea of having the speed and versatility of a Cray X-MP on your desktop seems ludicrous today, who knows what will happen in 5 or 10 years? The PC is far faster and more powerful than some large computers a decade old. What's exciting is that the race for performance is heating up fiercely. Whether the next startling performance advance comes from Wisconsin, Minneapolis, Armonk, or Tokyo, we'll all be the beneficiaries. ■

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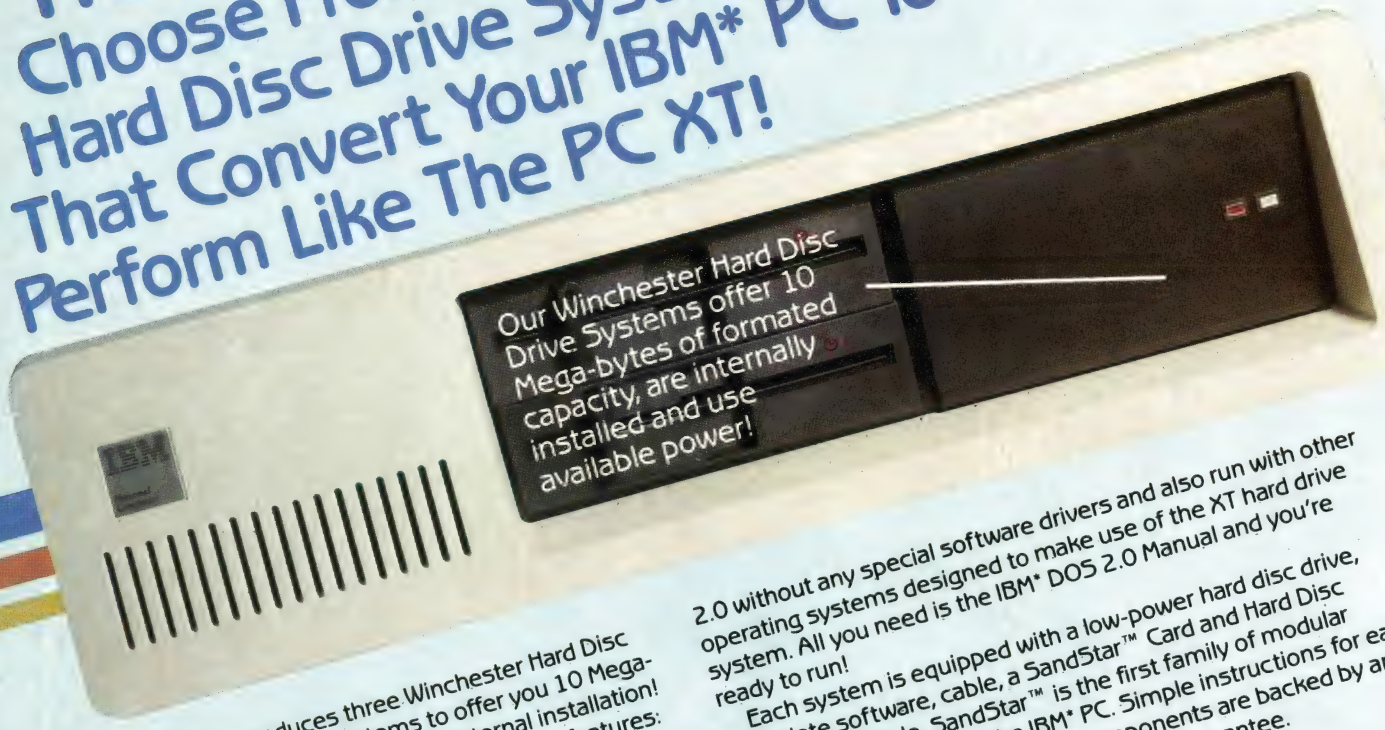

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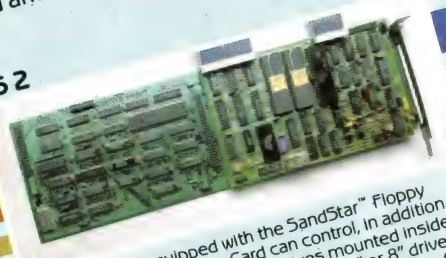
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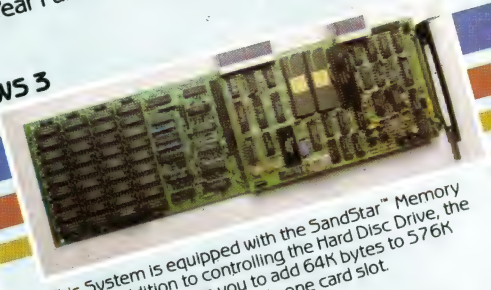
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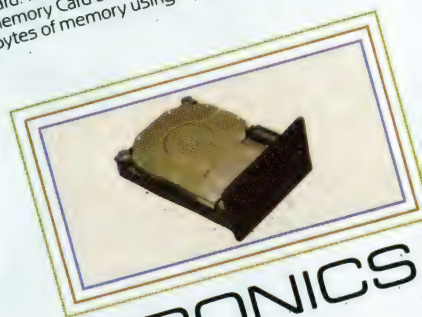


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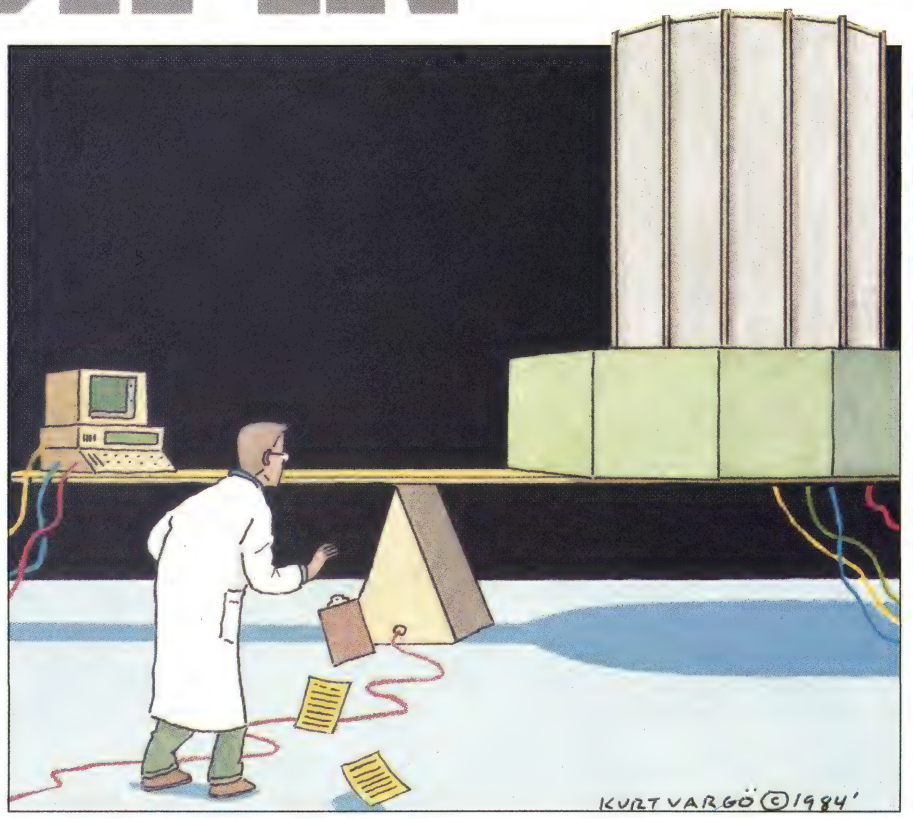
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# A Delicate Balance: PC & THE SUPERCOMPUTER WEIGH IN

A comparison of the tiny PC and the Cray-1 supercomputer may seem absurd, but the two are more alike than you might think. Many scientists, in fact, use this mighty machine duo as a team.



Here you sit, the most avid user of your company's Cray-1—that state-of-the-art supercomputer installed in its special environmentally controlled room. And on your desk sits your new IBM Personal Computer, complete with an 8087 mathematics coprocessor chip. Your boss has asked you to evaluate the PC as a tool to support the scientific work you now perform exclusively on the Cray-1. Isn't that like comparing a wind-up car with a souped-up Porsche? Maybe not. Scientists and engineers throughout the nation are doing just that and finding the Cray-1 and the PC more alike than they expected. Like the Cray, the PC can be programmed in the scientific language FORTRAN; for some applications it might even be the better choice. And many laboratories are hooking the Cray and the PC together to form an unbeatable team.

I work at the Department of Energy's Sandia National Laboratory in Albuquerque, New Mexico as its Cray-1 and IBM PC consultant. My job is to help research scientists and engineers find out what a PC can do and cope with the impact of microcomputer technology on their jobs. The IBM PC is not the only personal computer that is being evaluated for its potential for scientific work; nor does it claim to be a scientific computer, even when it's equipped with the 8087 coprocessor. However, for certain tasks, it can be compared with a supercomputer.

Until recently, the computational needs of the scientific community were met with the biggest and fastest computer that electronic technology could produce. The Cray-1 supercomputer, manufactured by Cray Research, Inc., is capable of performing up to 80 million floating-point operations per second, with up to 32 million bytes of addressable memory. Nonetheless, major national scientific laboratories agree that the Cray-1 is neither fast nor large enough for their projected scientific computational needs. With the increasing need for power and speed, what role can the PC possibly play in the shadow of this computing giant?

## A Factor of 1,000

The PC can be described as a "milli-Cray." In discussing the two, the factor of 1,000 recurs frequently. The list price of a Cray-1 is about 1,000 times that of a fully configured PC (roughly $6,000,000 versus $6,000). The Cray-1 performs many standardized benchmark tests approximately 1,000 times faster than a PC. And the Cray-1 requires about 1,000 times more space than the PC. However, the factor of 1,000 does not always apply; you don't need 1,000 PCs to do the work of one Cray-1. Nor do these figures represent a sufficiently detailed comparison with which to understand the potential uses of each machine for scientific computing.

The hardware differences between the Cray-1 and the PC are not as great as you might expect. Naturally, the gulf in storage capacity is wide. The PC's available internal storage depends upon how much RAM has been added, but will typically range from 320K to 640K bytes. Assuming you have carefully abided by the 64K boundary limits for subroutines and "common blocks" required by the current compilers, all of this memory except that used by the operating system is available to the FORTRAN programmer. The Cray-1 has 4 million words, each 8 bytes wide, or 32 million available bytes, from which you must subtract those used by the operating system. Many significant Cray-1 programs make use of an overlay loading feature of its operating system that is not currently available on a PC. It allows multiple subroutines to all use the same memory area for their code, so long as certain noninterference rules in their calling structures are observed. When needed, each subroutine is loaded from disk and overlays the common reserved memory area. Using this feature, carefully structured code that is ten times its physical memory size is often run on the Cray-1. Thus these supercomputer programs are often 500 to 1,000 times as large as those that could fit on a PC.

The PC and the Cray seem more similar when you compare the hardware that

Illustration: Kurt Vargo

performs the actual computational work (see Figure 1). To perform serious floating-point calculations on the PC you must use the 8087 mathematics coprocessor, and the numbers should be stored and computed as FORTRAN double-precision variables that are stored as what Intel calls "long reals," or long real numbers. These "long reals" make 64 bits available, which in scientific notation is split between an effective 53-bit mantissa and an 11-bit exponent. The 8087 does internal computation with an 80-bit temporary real-number storage that consists of a 64-bit mantissa and a 15-bit exponent, plus a bit to show the sign. On the Cray-1, standard floating-point numbers are stored in 64 bits, but are split between a 48-bit mantissa and a 15-bit exponent, plus a bit for the sign. Although the Cray-1 does not have separately addressable internal registers, for multiplication it has an effective internal mantissa of 92 bits. Thus mathematical accuracy, a major concern of scientific computing, is comparable between the two computers. The Cray has a wider standard exponent range, but the PC stores more significant digits and computes with equivalent accuracy.

Until recently, the computational needs of the scientific community were met with the biggest and fastest computer that electronic technology could produce.

Even the instruction sizes and operations of the two computers are similar. Instructions for both the 8087 coprocessor and the Cray-1 are either 16 or 32 bits in length. Both machines are register oriented. While the 8088 has only eight 16-bit general registers and the 8087 has only eight 80-bit registers, the Cray-1 has a total of 152 programmable registers separated into five different types, each dedicated to a specific activity. This amounts to more than 4K bytes of registers.

A special feature of the Cray-1 is its eight-vector registers, each consisting of a set of 64 64-bit registers. A single vector instruction can multiply all 64 numbers in one vector register by the respective 64 numbers in a second vector register and store all 64 results in a third vector register. Cray-1 Fortran DO loops are carefully constructed to take advantage of this hardware feature.

In a much more limited but similar manner, the 8087 internal circular register stack could be used as a "vector" for chained operations.

Both the PC and the Cray-1 can perform their floating-point operations at the same time as operations that do not affect the same memory locations. Separately identifiable instructions for the 8087 can run while the 8088 is also operating. Similarly, separately identifiable Cray-1 vector instructions can be executed while other operations, even other vector operations, are also running. Properly "optimized" scientific code, of which a high percentage of total execution time is for mathematical computations, can perform many of its nonmathematical operations "for free" in parallel while the computing is going on. To take advantage of the similar PC hardware feature, you may have to modify the generated machine code to permit the 8088 to perform significant work while the 8087 is computing. On the Cray-1, you can specify in the FORTRAN code that this parallel computation feature is to be used.

The factor of 1,000 pops up again when you compare the two computers' hardware speeds in performing mathematical operations. Their manufacturers list instruction times for both computers in integral ticks of an internal clock, but the measurement unit for the PC is 1,000 times larger than that for the Cray-1 (see Figure 2). The 8087 clock ticks every 0.2 microseconds, while the Cray-1 clock ticks every 12.5 nanoseconds. Intel lists the average time for the 8087 chip to perform a long real number multiplication as 27 microseconds. Cray Research lists the average time for Cray-1 to perform a scalar multiplication as 87.5 nanoseconds. For one mathematical operation in a series of operations performed using the vector registers and instructions, this performance time approaches 12.5 nanoseconds (a result every clock period) as the size of the data vector increases.

| Data Type | Bits for Exponent | Bits for Mantissa | Significant Digits | Range (plus or minus) |
|---|---|---|---|---|
| 8087 Long Real | 11 | 53 | 15 or 16 | 4.19E-307 to 1.67E308 |
| 8087 Temp Real | 15 | 64 | 19 | 3.4E-4932 to 1.2E4932 |
| Cray Real | 15 | 48 | 14 or 15 | 4.58E-2467 to 5.45E2465 |
| Cray Internal | 15 | 92 | 27 | 4.58E-2467 to 5.45E2465 |

**Figure 1:** *How the range and accuracy of the Cray-1 and the PC compare in representing complex floating-point numbers.*

## Software

When you compare the software available on each computer for scientific use,

| Operation | 8087 (microseconds) | Cray (nanoseconds) |
|---|---|---|
| Clock period | 0.2 | 12.5 |
| Multiply | 27 | 12.5 to 87.5 |
| Divide | 39 | 40.0 to 262.5 |
| Add | 17 | 12.5 to 37.5 |
| Store | 18 | 12.5 to 50.0 |

**Figure 2:** *Execution speeds of CPU functions for the Cray-1 and the PC.*

you can see some basic similarities between the two. Both have a FORTRAN 77 compiler for scientific code, an assembler for machine code optimization, editors to help construct and maintain the code, and operating systems to run the whole show. Both manufacturers have also announced that a UNIX-like operating system will soon be available for their machines. That is where the software similarities end. Because the number of PCs sold is so huge, many individuals and organizations are writing software for this lucrative market. Nearly all of this software is designed to be "user-friendly." Even the PC software specifically designed for scientific use emphasizes interface with the single user.

Conversely, software for the Cray-1 has primarily emphasized computational speed at the expense of ease of use. Further, because of the Cray-1's high cost and tremendous speed, its software has been designed for multiple simultaneous users. It has often been said that a Cray-1 is only for "friendly users" which is not the same as "user-friendly." In fact, the first Cray-1 installed at a scientific laboratory was delivered essentially without an operating system or a compiler. Although Cray Research now offers a complete line of software, and some additional software, including operating systems and compilers, is available from the Cray user community, Cray-1 computers are not a volume software market. At a Cray Users Group meeting this past fall, Cray Research listed only 41 Cray-1 installations in the United States and 22 more worldwide. The only significant places where individuals are writing software for the Cray-1 are the few national research laboratories and at Cray Research itself. As new generations of supercomputers supplant the existing machines, they will require completely new software to run them. I expect this trend for speed at the expense of user interface to continue.

The scientific community's need for direct user interface with Cray-1 codes is so acute that some scientific laboratories have replaced Cray Research's batch operating system, COS, with CTSS, an interactive operating system that the company itself wrote. No single company or even small group of laboratories can match the pace at which the software industry is developing interactive programming tools for the PC. At this moment no commercially available full-screen editors are available for the Cray-1, while so many are available for the PC that choosing among them is difficult. In fact, the only standard editors that do exist for the Cray-1 are not much different or more sophisticated than the PC editor, EDLIN. Since more than 10,000 times the number of PC's than Cray-1s are installed, user interface software products, which are so labor-intensive to produce, will continue to be more widely available for the PC than for the supercomputer.

## Input/Output

In addition to size and speed, the greatest difference between the Cray-1 and the PC is in their input/output methods. The PC is designed with I/O in mind. Its ROM includes drives for the keyboard, console screen, disk, and printer. Connectors on the back of the PC permit direct attachment of all kinds of input and output devices, including scientific laboratory hardware.

Cray Research designed the Cray-1 to communicate only to another computer, such as Cray's own I/O subsystem. This other computer must in turn talk to you or to other I/O devices such as an operator's console or a printer. Even those laboratories that have installed an interactive operating system on a Cray-1 need this additional computer to control the terminal interface.

Both computers have on-line disk capacity for data storage and I/O, and here the factor of 1,000 returns (see Figure 3). Where the standard for the PC is a floppy disk, or for the XT a 10 million byte hard disk, the Cray-1's hard disks can store 606 million bytes. Twenty such disks are com-

| | PC Floppy | XT Hard | Cray Hard |
|---|---|---|---|
| Capacity Megabytes | .36 | 10 | 606 |
| Quantity | 2 | 1 | 20 |
| On-line Megabytes | .72 | 10 | 12120 |
| Data Transfer (Megabits per second) | .25 | 5 | 38.7 |

**Figure 3:** *Data storage capacities of the Cray-1 and PC.*

monly connected to a Cray-1, which means it has 1,000 times as much on-line storage as an XT. Further, nearly all Cray-1 computers are connected to a multiple computer network that can directly transfer and store files onto other computer systems. A typical floppy disk drive can transfer data as fast as 250 kilobits per second, or a hard disk at a rate of 5 megabits per second. The transfer rate of a Cray-1 disk is 38.7 Mbits per second, which is considered so slow that it is a major bottleneck in the system's functioning. Many PC vendors sell RAMdisk software to increase the data transfer rate to the I/O bus limit of 9.5 Mbits per second. Cray Research offers an I/O subsystem that acts like RAMdisk and will speed the Cray-1's data transfer rate to 850 Mbits per second, over 1,000 times that of a floppy disk.

## Usage

The best uses for the Cray-1 and the PC to support scientific research became obvious when you consider their unique characteristics. Although each is superior in its own particular area: both are used for code execution, data input, and data output.

With the emergence of standard scientific PC FORTRAN compilers, many scientists are beginning to use PCs to run at least parts of some scientific programs. At a scientific laboratory, it is common for people to write FORTRAN programs in a clean, standardized dialect of FORTRAN so they will be easy to compile and run on many different computers. As a test example, I converted the Sandia National Laboratory's set of benchmark programs to run on the PC. I subdivided a large "common block" into three smaller blocks so each would be under 64K. I could compile and run this set of codes on the PC with an 8087 coprocessor. Since at most laboratories, Cray-1 computers are used to the fullest extent, many people are interactively writing, debugging, and running small pieces of standardized Cray-1 FORTRAN code on a PC. Using a communications package, the developed code is then uploaded to the central computer network where the Cray-1 will make the longer production runs.

> The PC is enormously helpful in preparing scientific reports because it can directly combine the downloaded results with explanatory text.

A 1-hour job for the Cray-1 may take more than 40 days and nights on a dedicated PC, but a scientist might not get back a 5-second test for an hour from a heavily used Cray-1 system. A PC could also deliver this test run in an hour.

## Data Input

As I mentioned earlier, the Cray-1 needs another computer to feed it input data. In many laboratories, the PC is now used for this purpose. Often, the PC must perform three very different I/O functions. First, a PC may be tied directly to the laboratory equipment so it can electronically read and record test results. Second, the PC can be used to easily reformat that raw data into the form the Cray-1 needs. Third, a communications program on the PC allows that data to be sent directly to the central computer network. It is because the PC is a full-scale computer in its own right, able to be as flexible as the programs it runs, and designed to interface with I/O equipment, that this single piece of hardware can perform three such varied functions. A single piece of hardware performing all these functions eliminates the need for time-consuming data retranscriptions and conversions at each step. Because PC software is designed for the *user*, the tedious chore of preparing data for the Cray-1 becomes much easier.

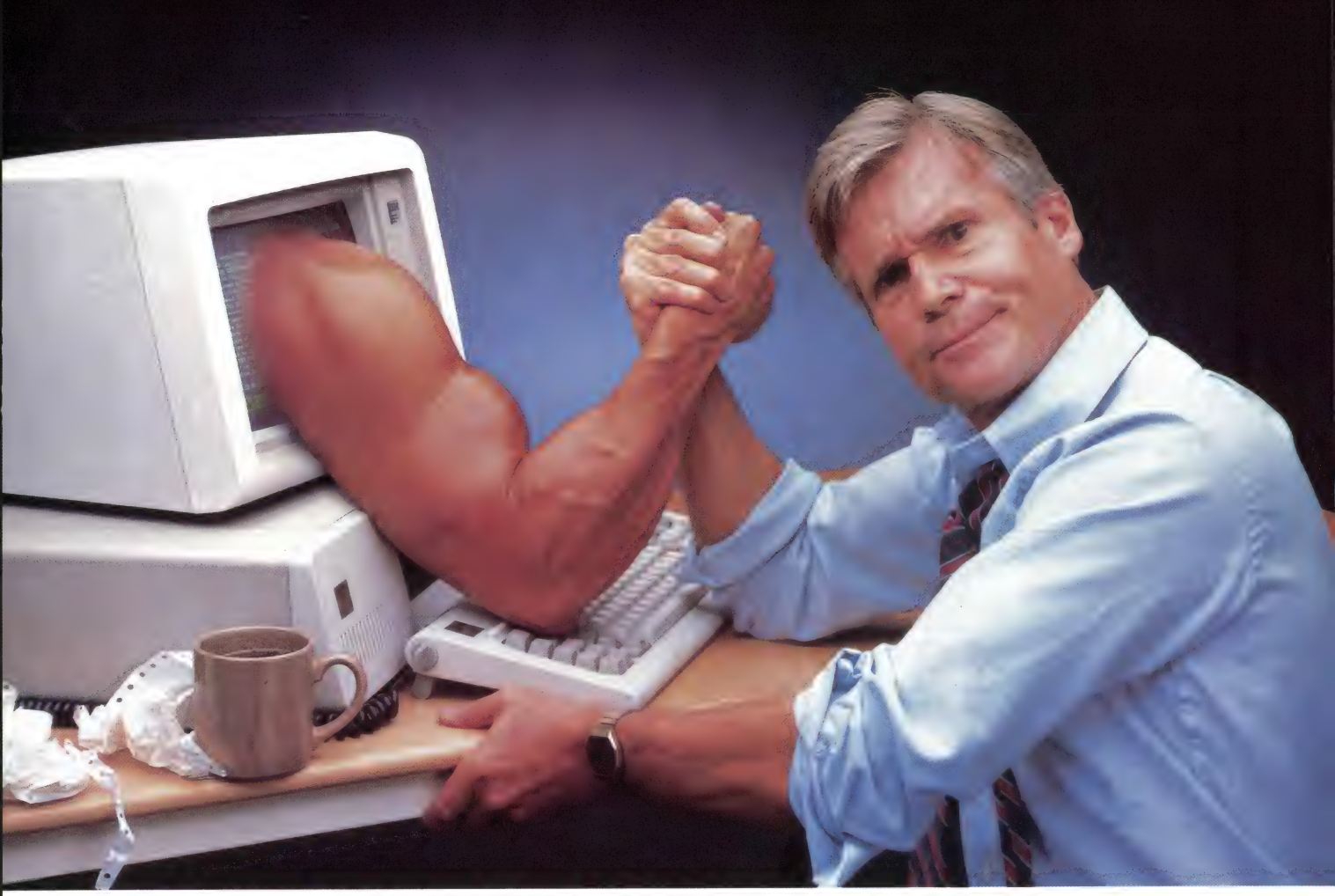
## Data Output

The most significant use for the PC among Cray-1 users is in manipulating output data. Not only does the PC permit users to view both the numerical and graphical results of a Cray-1 job while it acts as a terminal, but it can download these results and manipulate them with its own software especially with sophisticated graphics packages. The PC is also enormously helpful in preparing scientific reports, not only because it runs word processing programs that can handle mathematical symbols and formulas, but also because it can directly combine the downloaded results with explanatory text. Since highly technical scientific reports are generally a clerical nightmare, this has been a boon to the scientific community.

## Summing Up

The combination of the PC and the Cray-1 as important tools in scientific computing reflects the law of the excluded middle: There is a great need for the large and the small, but the in-between computer is neglected. Despite their differences the unique characteristics of the IBM PC and the Cray-1 make them both productive tools in the scientific laboratory. To take advantage of the Cray-1's speed scientists must modify their thought processes and program code to conform to its hardware architecture. In contrast, the PC's advantage is that its interfaces are easily modified to conform to the needs of both users and other computers. Harnessing these two machines as partners gives scientists the best of both worlds. The little user-friendly PC can help to solve problems on the big high-speed Cray-1. ■

*Michael J. Hannah is a computer user consultant at Sandia National Laboratory in Albuquerque, New Mexico. He has been a technical consultant to computer users at various laboratories and in the Air Force for over 20 years.*



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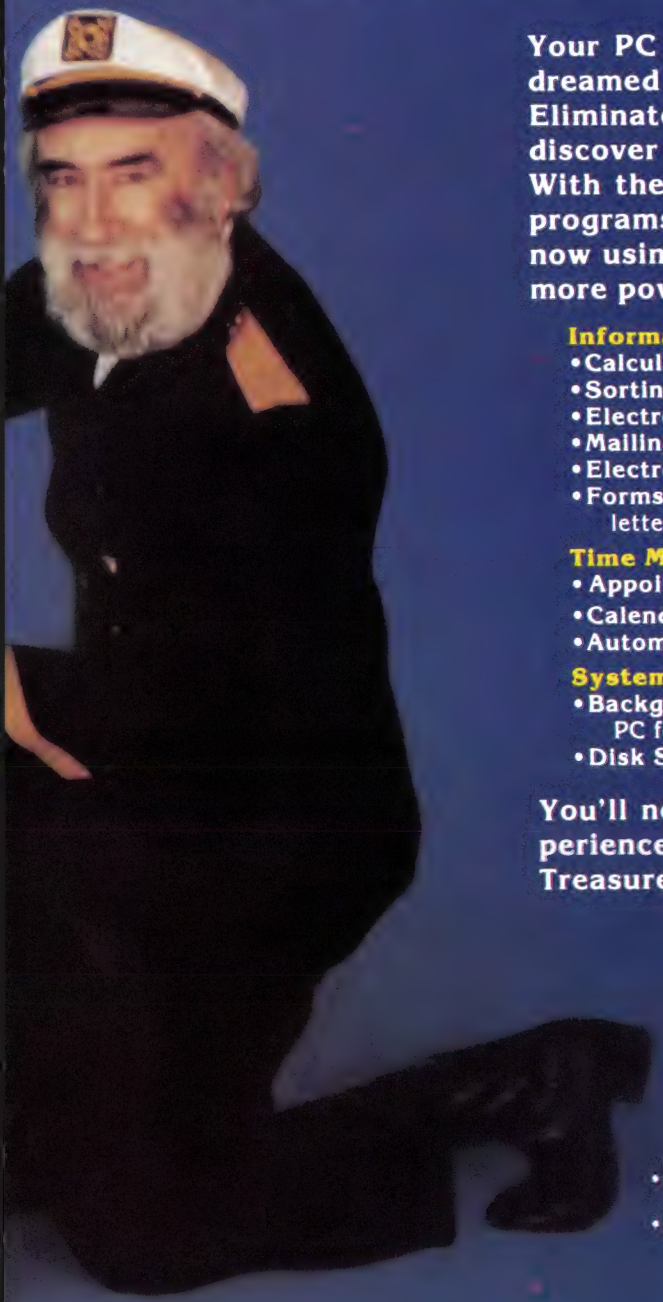
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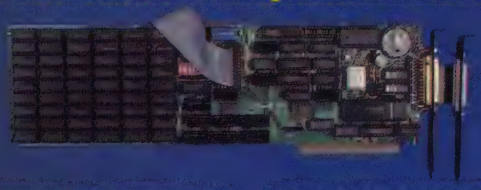
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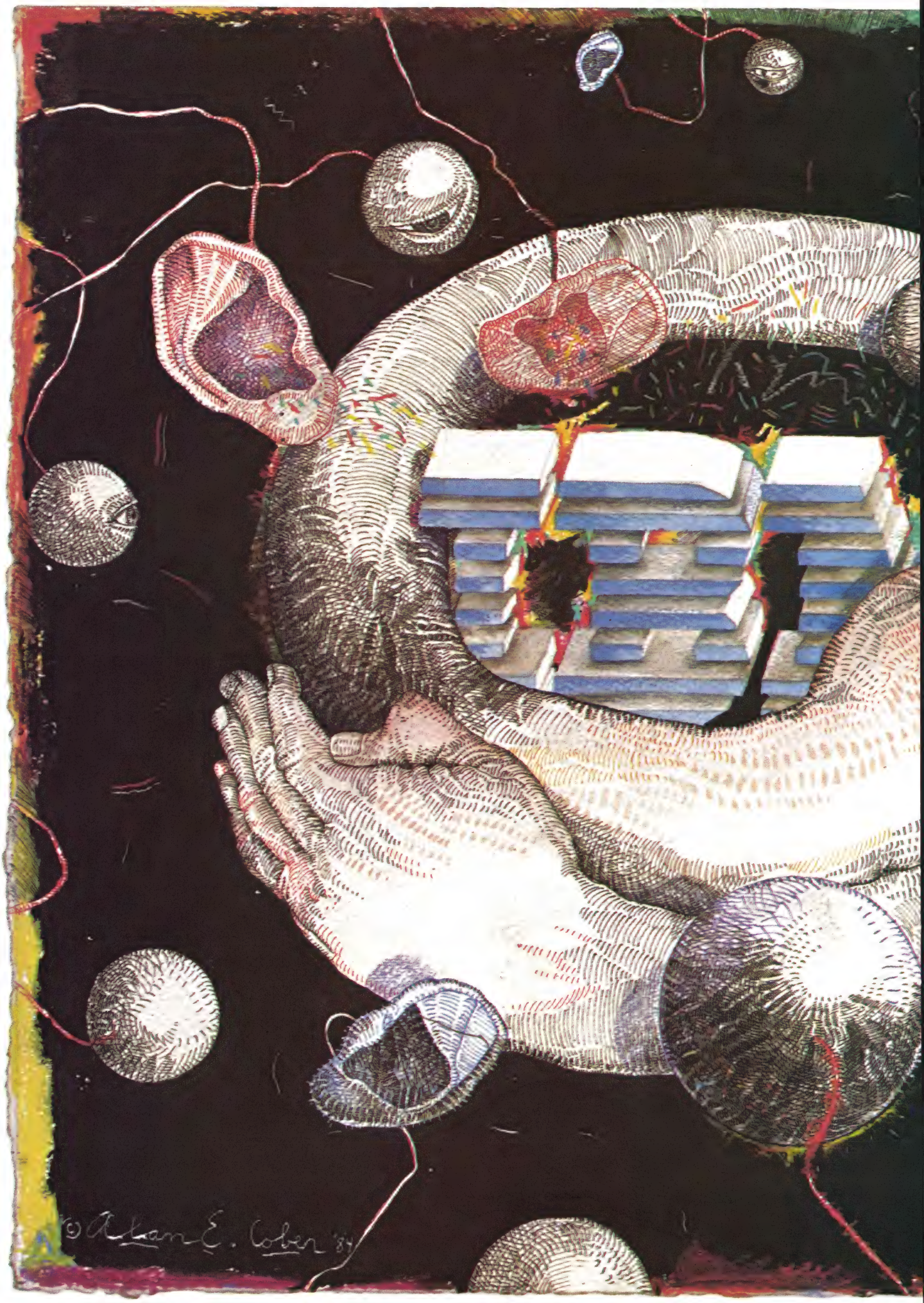
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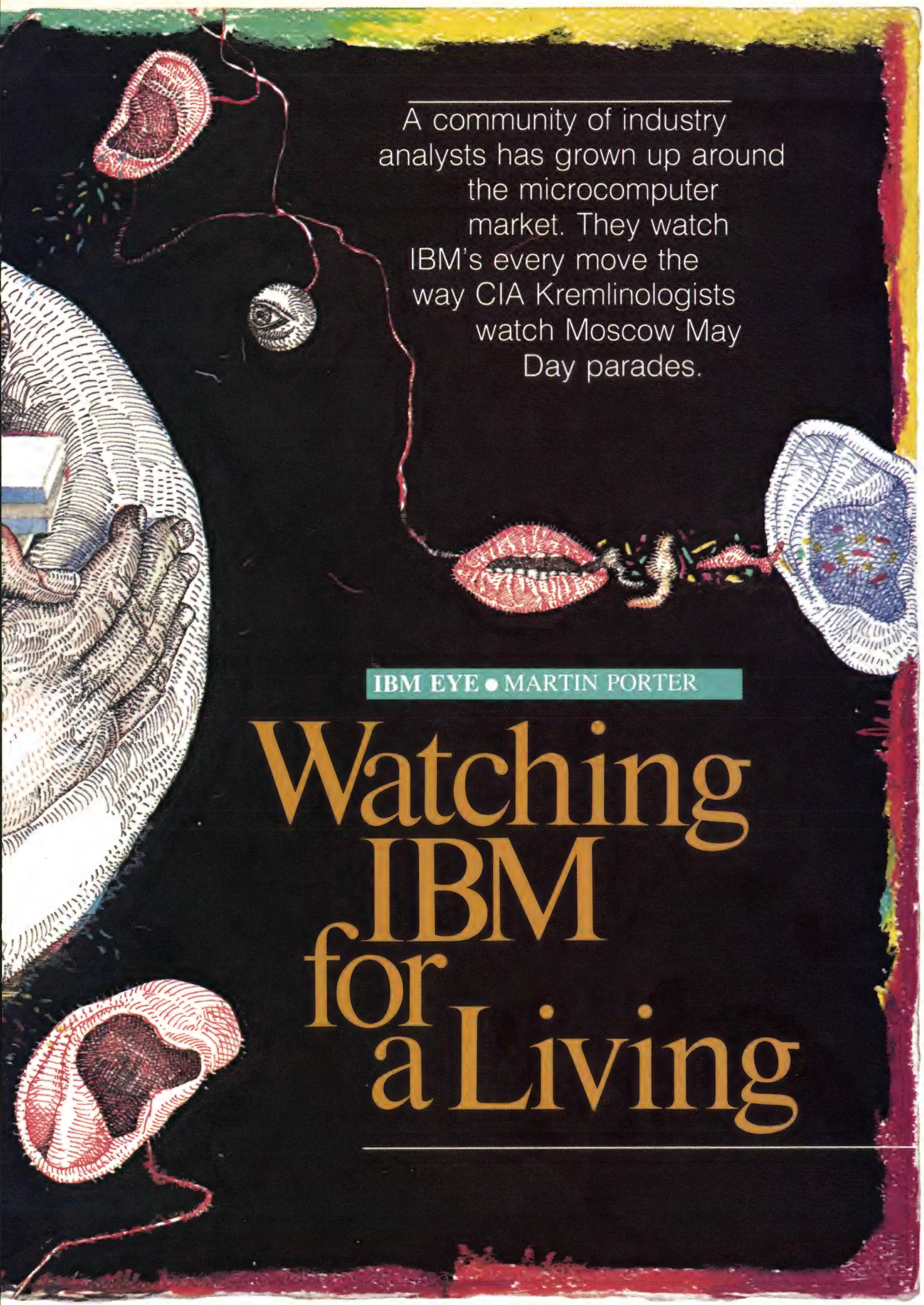


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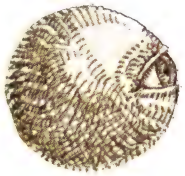


A community of industry analysts has grown up around the microcomputer market. They watch IBM's every move the way CIA Kremlinologists watch Moscow May Day parades.

IBM EYE • MARTIN PORTER

# Watching IBM for a Living

Illustration: Dr. Alan E. Cober



In a posh meeting room at New York's Plaza Hotel, Yankee Group founder and president Howard Anderson leans on a lectern, his face illuminated by a slide projected overhead.

"Watching IBM is like playing half-court basketball with your best friend," the tall, curly-haired telecommunications expert remarks. "After a while you're able to predict its every move."

A hall full of management and planning executives from companies such as IBM and AT&T had paid Anderson's Boston-based consulting firm $795 apiece for breakfast, lunch, cocktails—and 2 days worth of predictions about how Big Blue intends to play ball in the office and at home.

Within the personal computer industry is a community of analyst and industry watchers like Anderson who charge big money for their opinions, newsletters, and research forums. Most of them are young and articulate, understand statistics. Some of them even write well. No matter who they are, what they always offer is self-assured assessment of an industry that everyone is trying to figure out.

**Strong financial control is the reason Big Blue is blue chip on Wall Street.**

Industry analysts hold social gatherings. They make predictions. They even review products. But most of all they watch—they all watch IBM.

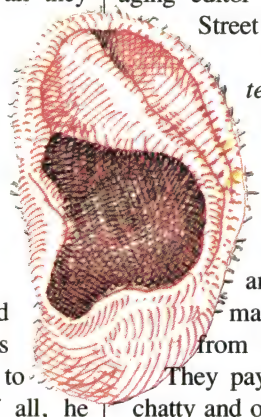
## The IBM Watch

Twenty-nine-year-old Frank Gens, a former marine biologist, is "chief IBM watcher" at Anderson's Yankee Group and edits the firm's IBM newsletter, *Impact: IBM*. Gens uses a combination of inside information and data from the Yankee Group's database of industry statistics to develop his analyses. Most of all, he admits, he uses plain common sense. "(IBM) is a very intelligently and logically run company. It is not a technology-driven business but one that's controlled by the financial people," he says.

This strong financial control is the reason Big Blue is blue chip on Wall Street, and why most major brokerage houses have one vice president glued to a terminal 8 hours a day, watching IBM.

"IBM doesn't just influence the market, it creates it," says analyst Esther Dyson, a 32-year-old former *Forbes* magazine reporter who purchased the 13-year-old *Rosen Electronics Letter* from venture capitalist Ben Rosen in June, 1983. "IBM is the sea in which we all swim."

Dyson's name gets around a lot these days, not because she is an expert on hardware or software, nor even because her stint as a Forbes magazine writer taught her where the money is, but because she works hard, writes with an edge, and knows how to talk to reporters. Before she bought the newsletter, Dyson was its managing editor and a consultant to Wall Street firms.



*The Rosen Electronics Letter* was once the source for the inside scoop on the semiconductor business. Dyson's version, which no longer covers semiconductors, is called *RElease 1.0* and has 2,000 subscribers, many of whom are holdovers from the semiconductor days. They pay $395 a year for Dyson's chatty and opinionated publication.

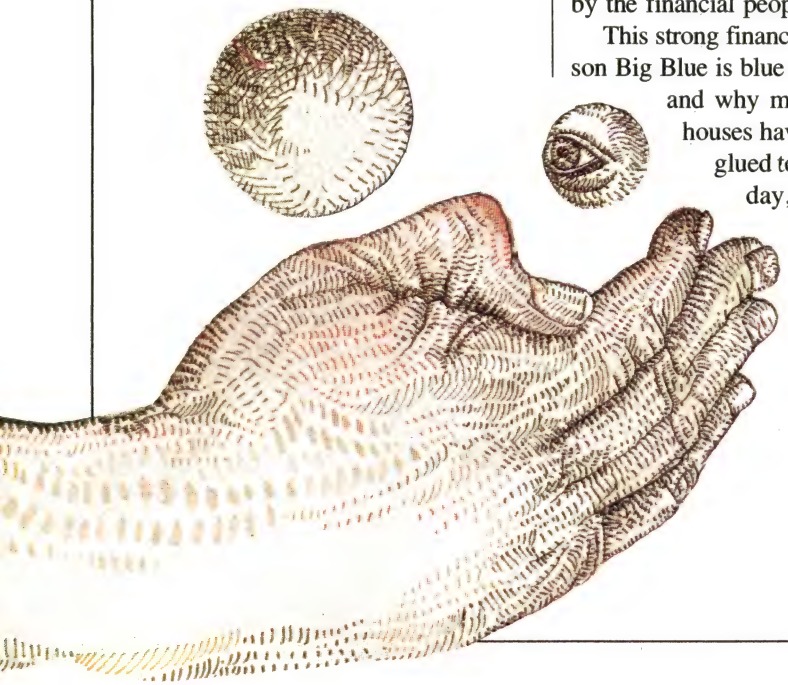
## A Good Story

Despite her Wall Street background, Dyson distinguishes between those who cover the computer industry for the industry and those who cover computers for the "big board."

"My loyalty is to the computer industry, not to the analyst community," Dyson explains. "I'm not interested in the stock prices. I'm more interested in the dynamics of the industry, marketing position, and market share."

There are similarities, she admits, between her activities and those of Wall Street analysts. "The truth is, even on Wall Street the real trick is to tell a good story, because no one knows what stocks will do. As long as you can make a good case for your story, the clients love you, but it's still storytelling. To some extent, so is what I do now."

In addition to telling her computer industry marketing and dynamics stories,





Dyson also bills $2,000 a day for consulting, a high fee for someone who finds hardware "boring" and who refers any client who asks for statistics to her colleague Portia Isaacson of Future Computing, located in the Dallas suburb of Richardson, Texas.

Portia Isaacson is a homespun and determined woman who has a pure computer pedigree in an industry full of half-breeds. She began with a Ph.D. in computer science, worked in private industry as an engineering manager for microprocessor operating systems and computer architecture, and later opened Texas's first computer store in 1976. She is also the mother of three sons and, not incidentally, the wife of Dr. Egil Juliussen, a leading business analyst and forecaster. "You might say Egil is our product and I'm its salesperson," Isaacson says.

In a little over 3½ years, she has built Future Computing from a company with two employees (herself and Juliussen) and no capital into one with over 100 employees that expects to do $9 million dollars worth of business in 1984. The company runs five different newsletters (for each of which it charges about $400 per year), publishes various reports (about $300 each), and offers a range of personalized services to both manufacturers and end users.

One of Future Computing's latest ventures is an IBM PC compatibility lab that will test any machine to determine how "operationally compatible" it is with the PC. The computer is subjected to a battery of tests and run with over 50 different software programs. Its documentation is picked apart. The end result is a 50-page written report on the product, with a price tag of between $5,000 and $7,000.



The machines that have proved to be the most compatible so far are those that have been on the market the longest, such

## A Few High-Priced Words

What business wisdom could possibly be worth $2,000 to $3,000 per day? Here is a sampling of opinions and projections from the analysts that even IBM goes to for advice.

### Amy Wohl, Advanced Office Concepts

In the 20 years since the word processing market's inception in 1964, about 2 million workstations have been delivered. In 1983, IBM delivered about 700,000 PCs. We estimate that at least half of them ended up as workstations in large companies. If you add to this number the IBM compatibles used as workstations, about 150,000 machines, you'll have a total of some half million workstations. In 1984, it's estimated that IBM will deliver 2 million machines, one third of them PC*jr*s and the rest PCs and XTs. By the end of 1984, probably as many PCs will be used as workstations as all the word processors that have ever been delivered. The old model of office automation, which said that offices would expand from word processing by adding functions, is probably now incorrect."

* * *

"IBM is working on a high-end workstation for a 1985 announcement. I'm fairly sure it's a UNIX-based product and I think what IBM is doing is very clever. By first releasing UNIX for the PC (PC/IX), it will create a marketplace in which a lot of applications software for that workstation will be written in advance of its announcement. I feel that PC/IX represents a bridge for the PC user to the next level of systems to come."

### Portia Isaacson, Future Computing

"We're pretty positive about the PC*jr*. It's hard to make predictions about it, although we have said we think it will stimulate enough demand in the market to sell a half-million units. But the puzzle, we think, is the shortage of 8088 chips: where will IBM use the chips it has? The first year of PC*jr* production and sales will be determined by IBM's chip allocation."

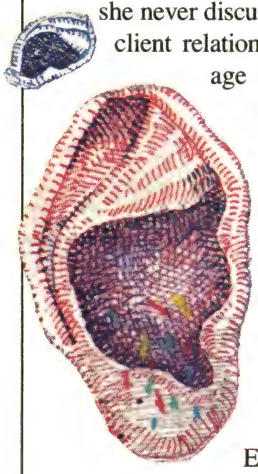
### Frank Gens, The Yankee Group

"I think you'll soon see less-expensive versions of the XT/370 that will cost somewhere in the $5,000 to $6,000 range—for example, a VM (virtual memory) machine that can run different guest operating systems, such as UNIX, DOS, and CP/M. IBM is pushing VM as a rival industry standard for microcomputer operating systems against DOS and CP/M. I can predict that within 2 or 3 years VM is going to be one of the major PC operating systems."

* * *

"I don't envision a $5,000 workstation being able to do some things, such as database management, until 1988 or 89. Now, to run a real relational database, you have to go to a machine with the power of a DEC VAX or Data General minicomputer. I think the proliferation of PCs will fuel the growth of minicomputers over the next 3 or 4 years, contrary to what most people believe. I think the minis are going to change. They will become controllers for clusters of microcomputers. But in order to take advantage of the clusters of microcomputers, mini vendors will have to drive their prices closer to $20,000 to $30,000."

as the Columbia and Compaq models, Isaacson discloses. Normally, she adds, she never discusses her confidential client relationships.'' ''We manage the ethics of our information very carefully,'' she says.



## Confidentially Yours

Their access to information places computer analysts in a uniquely awkward predicament. Even if they sign nondisclosure agreements, how can analysts omit from their commentary inside information they know? Even if they do not directly reveal it, the information will affect their analyses.

Amy Wohl of the Bala-Cynwyd, Pennsylvania-based firm Advanced Office Concepts admits, ''You have to walk a thin line. Each vendor or user company you work for realizes that you know a lot about its competition. But it also knows your reputation for ethics and discretion.''

> "About half of our customers would not consider a non-MS-DOS machine under any circumstances."

Does the security-conscious IBM trust Wohl and her peers?

''They see us as necessary nuisances, I think,'' Wohl says. ''Some of us do considerable consulting for IBM, have many contacts at IBM, and so know a lot about what IBM is planning.''

IBM can also use this exchange of knowledge to its own advantage, however—several analysts say they may have been used to leak information to the press and Wall Street.

With her partner Dr. Howard Morgan, a former professor at the Wharton School and a longtime researcher in the computer industry, Wohl, 42, has built a specialized consulting practice in the office automation field that until recently dealt very little with IBM. The emergence of the PC workstation and Big Blue's recent marketing push in this area has made Wohl an IBM watcher by default.

While at McGraw-Hill, the publishing company, Wohl did market research and vendor analysis for office automation clients before the industry existed. Those clients were the firms that would ultimately create the marketplace. This experience led her into business for herself, and today her services are available for $2,000 per day. Her newsletter, *Advanced Office Concepts* (*AOC*), costs $135 per year, she publishes three *Market Guides* that are updated monthly, and her company is currently working on an end-user consulting job that will ultimately select 6,000 workstations for a corporate site. What story does she tell for her high stipend?

''People are switching from top-down design, in which the system determines the workstation, to bottom-up design, in which you pick workstations and then find systems that will work with them. That change in strategy, of course, has resulted from IBM's success in selling the microcomputer to the business world,'' Wohl says.



The basis of such commentary is more than sheer intuition; part of any analyst's job is collecting statistics.

Recently, *AOC* contacted 25 of its largest customers to ask if they had yet chosen one personal computer or personal computer environment as a corporate standard. All 25 replied that they had standardized on the IBM PC or, in a few cases, another MS-DOS machine. ''About half of our

*(High-Priced Words continued)*

### Patty Seybold, *The Seybold Report*

''If you're planning to automate your office, you have a choice between putting in a multimillion dollar office system now and worrying about whether you made the right decision, or sitting tight and handing out PCs as a stopgap measure—the latter is what people are typically doing now.''

* * *

''Apple has a future, but I'm not sure how important a niche it will have in the office marketplace. If Apple makes large OEM deals with major minicomputer makers to supply office automation systems, it may make a difference.''

### Esther Dyson, *RElease 1.0*

''IBM will become much more aggressive in software. One way or another, it will enter the applications business. How precisely IBM will do that is a subject of much nervous discussion. Despite its resources, getting all of IBM to work together is like trying to get the Japanese electronics companies to work together. IBM's corporate staff is probably finding the various divisions a little more independent than anyone really likes. One part of IBM has just adopted interactive UNIX; are the others going to fall in line?''

* * *

''I think the PC is going to decline into a secondary role as IBM comes out with new hardware, the way the Apple II did. Not that IBM will stop making it, or that it will stop being a standard for which a lot of software is written, but the sex appeal, razzle dazzle, and focus of attention will move elsewhere.''

* * *

''IBM is saying, under its breath, that UNIX is not an AT&T standard, it's an industry standard. Simply by being there with PC/IX, IBM takes some of the power from AT&T.''**—M.P.**



customers said they would not consider installing a non-MS-DOS machine under any circumstances,'' observes Wohl.

This kind of market presence is quite an achievement for a company that 3 years ago was invisible outside the typing pool. Nevertheless, Frank Gens sees the *PC*'s entire development as simply a ''fortuitous series of events'' for IBM.

''Apple and Tandy Computers had been making their way into offices. Whenever anything happens in data processing at any level in companies that are IBM's large accounts, IBM notices. The PC was first developed as a defensive product. Then all of a sudden, IBM recognized that its micro was a darned good revenue vehicle,'' he says.

Patty Seybold, the Boston-based editor of the *Seybold Report on Office Systems and Professional Computing,* maintains that IBM still has a long way to go in the market. ''IBM has a well-defined but rather slow strategy, which is frustrating to users. For example, it doesn't yet have the departmental office system network that everybody wants.'' Seven years ago, Seybold began the family company's word processing newsletter. Today, for $1,200 a day, she offers critiques and analysis on

# What the Experts Buy

## Every IBM watcher needs at least one PC for reviewing new software. But what other machines do these microcomputer consultants purchase for their homes and offices?

Like movers and shakers in many growth businesses, IBM watchers themselves are constantly shopping and spending for new equipment. A range of computer hardware and software arrives in their offices for testing, but what machines do they purchase themselves?

Their decisions are based largely on the software they must review for their clients, so at least one IBM PC is standard equipment in every office. For example, Amy Wohl's staff of 14 works on a range of IBM and CP/M machines. However, as far as a corporate system is concerned, Wohl is still looking.

''We were hoping that someone would come out with a product highly compatible with the IBM PC that was cheaper, because we don't particularly care what the brand name is, we just care if it runs IBM software successfully. But so far, we haven't found what we are looking for, so we may have to go out and buy IBM PCs,'' says Wohl.

What she really wants, she adds, is an IBM local area network, since her company uses a variety of databases ranging from information about hardware and software to mailing lists and subscriptions. Currently she has an XT stationed in her office, an assortment of word processing equipment, and a Franklin and an Apple Lisa to work with at home.

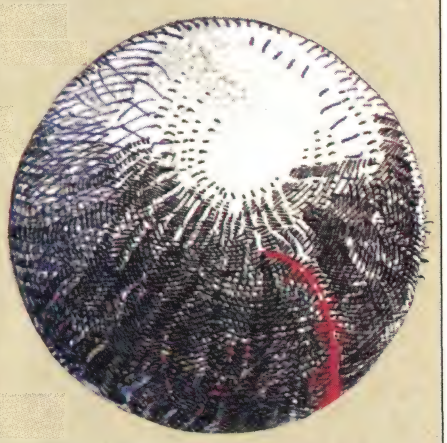
Frank Gens recently picked up an IBM PC for home use, although the Yankee Group headquarters is equipped with IBM, Wang, DEC and Apple computers. The company's production work is done on a Wang word processing system, although Gens admits, ''We're quickly outgrowing that and our applications are requiring more computer.''

''There was a bit of controversy—call it active discussion—at the Yankee Group recently concerning how to expand our system beyond word processing. Basically, it came down to a couple of choices. One was an IBM PC. But since everybody had put in thousands of hours on the Wang word processing systems, some people were leaning toward the Wang PC.''

No one wanted to peg his or her allegiance to any single system. Esther Dyson's office is equipped with an Apple III for word processing, a Lisa for graphs and pictures, and PCs and Compaqs to run *1-2-3* and *PowerBase*. The Seybold offices use a slew of IBM PCs and Kodak's Atex Publishing System.

''There are a lot of machines to choose from,'' Gens makes sure to mention before the interview tape runs out. He is echoing the neutrality of many of his peers.

I hope that's not all they tell their clients.—**M.P.**



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topics ranging from office automation to word processing.

## Predictions

When or if IBM will develop an advanced office network is what customers want Seybold and her colleagues to tell them. To a great extent, making accurate predictions is what the computer analyst's job is all about. For example, Seybold predicts that IBM will release a word processing keyboard for the PC this spring.

In 1979, the Yankee Group predicted that an advanced workstation would emerge. That prediction predated the application of the microcomputer in the workplace. According to Gens, a number of clients partially based their plans on that report.

Two weeks after the IBM PC was first introduced, Future Computing predicted its success with a white paper called "IBM's Billion Dollar Baby." Portia Isaacson still quotes those initial figures.

"We predicted what would happen in the market very specifically—we foresaw the IBM compatible phenomenon and that the PC would become an industry standard. We predicted that IBM would introduce the hard disk first, but it came out later than we thought it should have. The IBM home computer version also arrived a little later than we expected."



"One thing that really matters in this business is the ability to get people to sit down and talk to you."

It was its forecasting aspect that first attracted Esther Dyson to market analysis. "It mattered whether I was right or wrong in my work, not just that I told a good story," she says. She predicted that Apple's Lisa was flawed and that Digital Equipment Corporation didn't know the first thing about retailing.

Why, in a predominately male industry, are so many successful IBM watchers women?

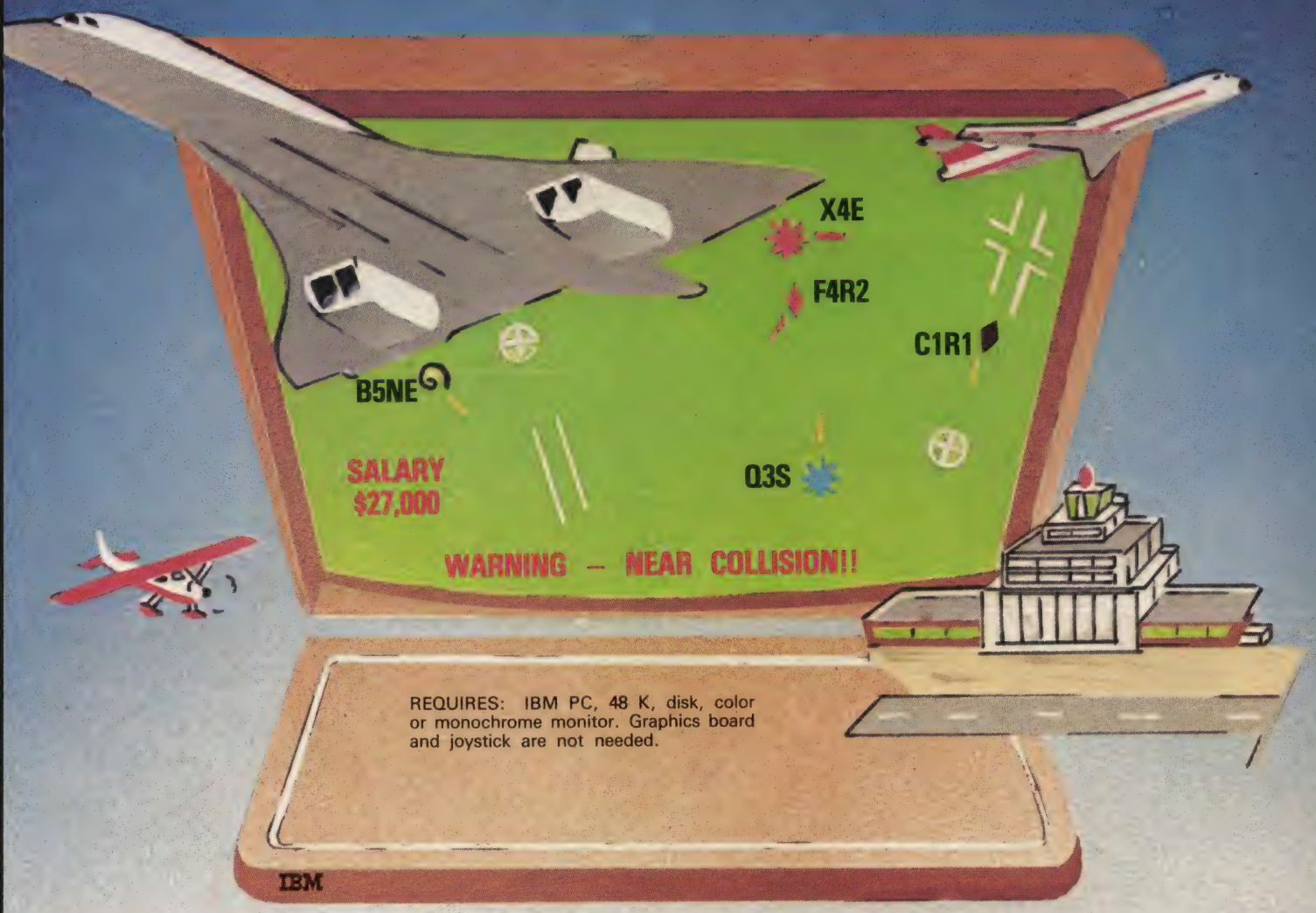
Dyson explains, "One thing that really matters in this business is the ability to get people to sit down and talk to you. Being a woman helps."

Portia Isaacson has her own explanation: "Maybe we're just easier to remember," she smirks. "All you men look alike."

The analyst's life is a busy one. Dyson is based in New York City but spends at least 2½ weeks on the West Coast every month. Amy Wohl is on the road 3 days a week. The schedules of Jean Yates (a San Jose UNIX expert whose stock as an industry watcher has jumped since IBM's PC/IX announcement) and Patty Seybold were so crammed that my interviews with them had to be put off for weeks at a time.

"What makes you good in this business," advises Amy Wohl, "is the constant fear that you're getting out of touch. You're always running to keep up with what's going on." ■

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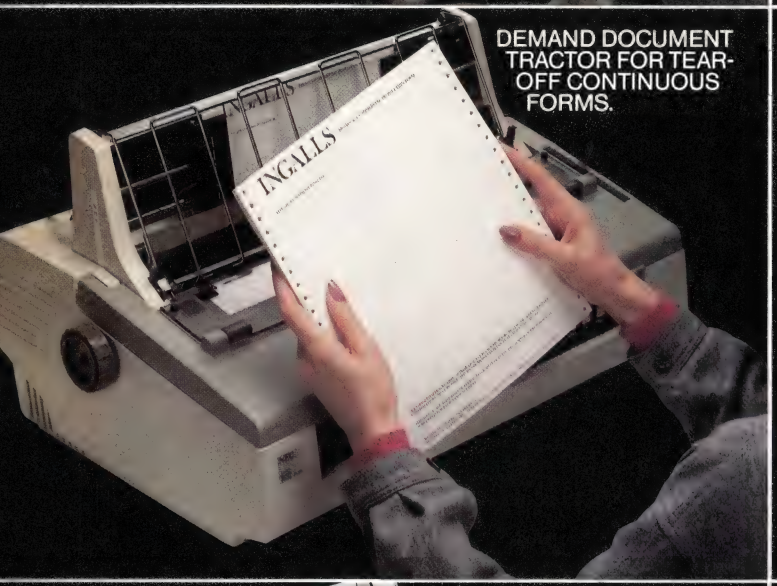
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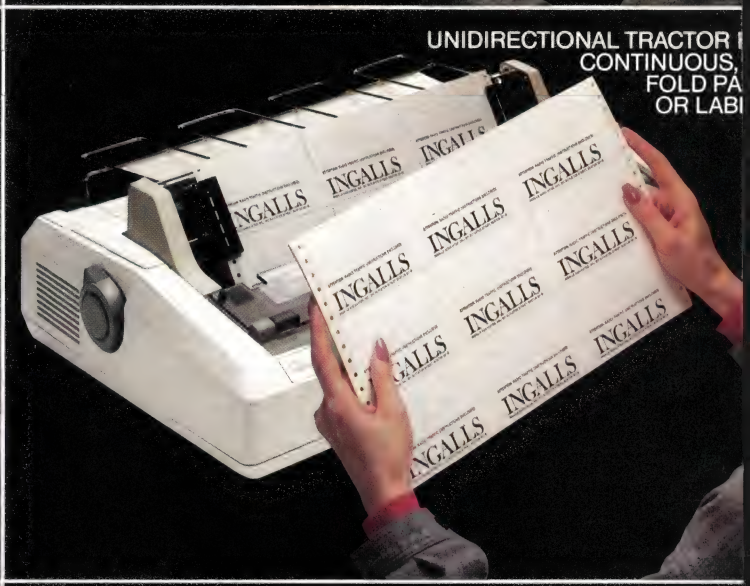
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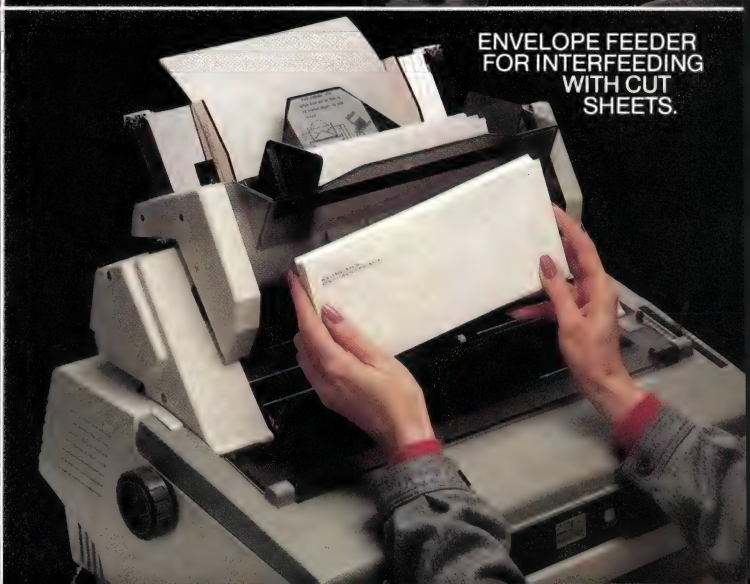




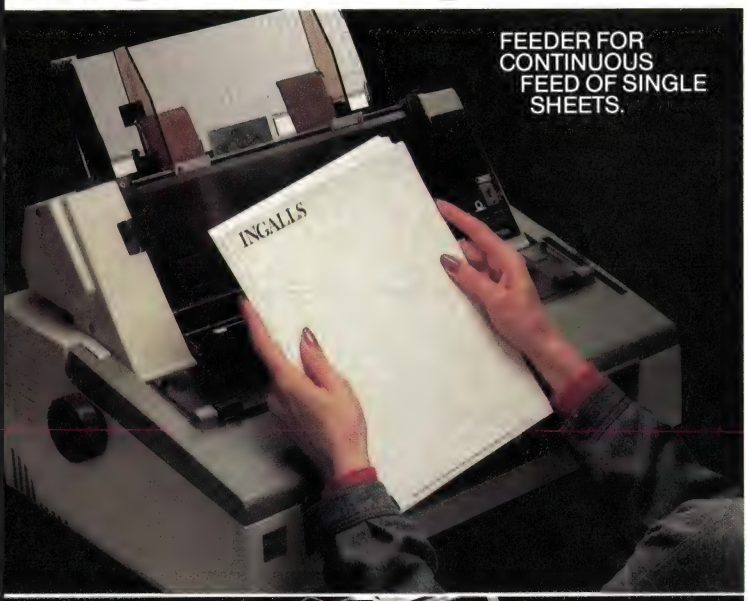









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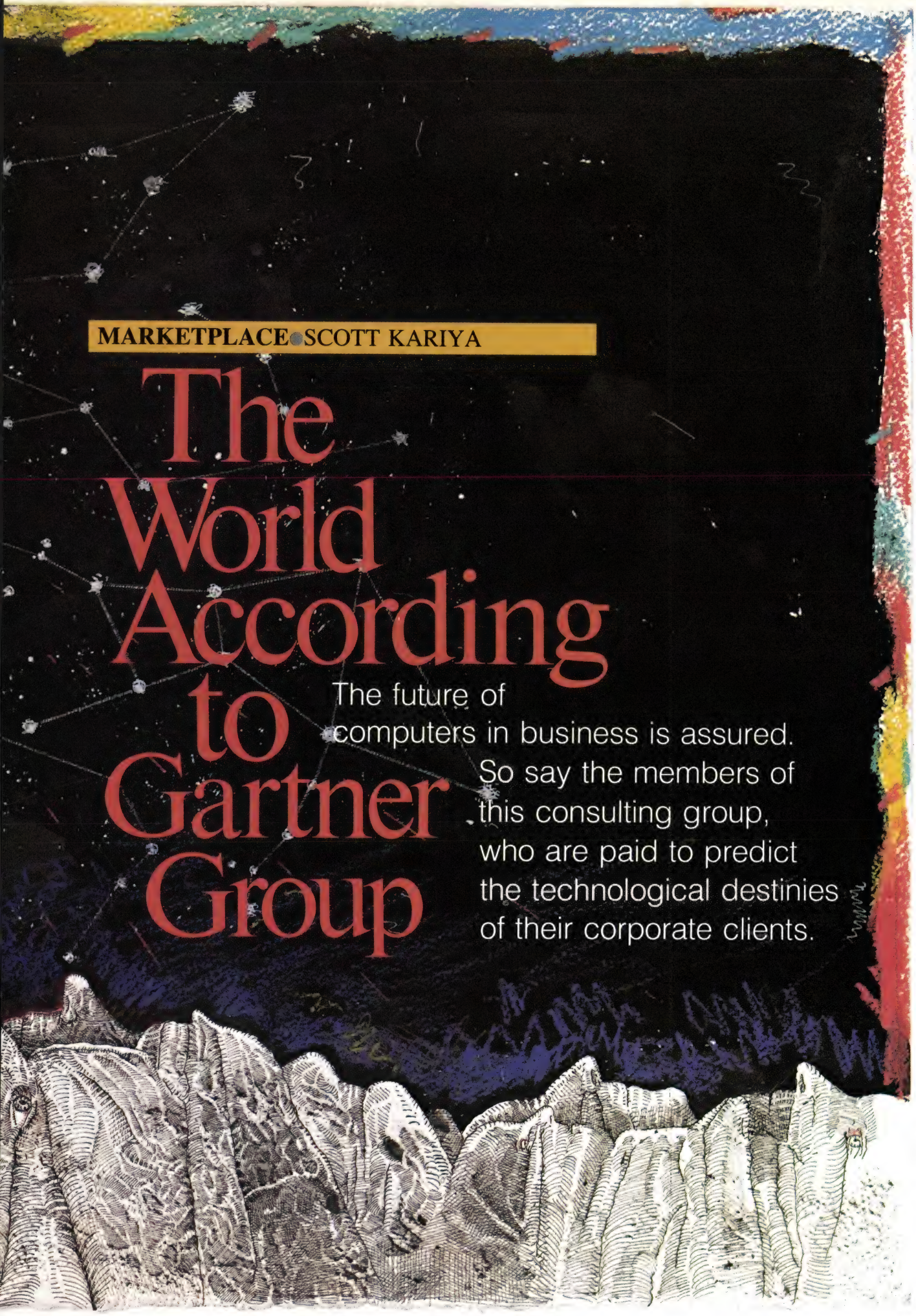
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# The World According to Gartner Group

The future of computers in business is assured. So say the members of this consulting group, who are paid to predict the technological destinies of their corporate clients.

Illustration: Dr. Alan E. Cober

Chatting with members of Gartner Group is an excursion into the future. They speak of artificial intelligence, electronic imaging systems, and component integrated workstations with such matter-of-fact conviction that it's hard to remember that these systems, for the most part, now exist only in engineers' dreams. But Gartner Group is no high-tech think tank or science fiction society. Major corporations pay millions of dollars to gain this consulting group's insights into the future of business technology. The future is not some pie-in-the-sky vision here, but the inevitable fusion of accelerating technological advances and social adaptation. At Gartner Group, it's called strategic planning.

Although the future may be predicted here, Gartner Group's modern office in Stamford, Connecticut, packed with laser printers and display stations, is hardly an appropriate setting for fortune tellers. The visions that emerge from Gartner Group reflect the work of a large professional staff with many years of experience in the information processing business. Their conclusions are fueled by torrents of statistical data, research on emerging products and trends, and consultations with hundreds of sophisticated corporate clients. Many of the principals in Gartner Group have made strategic product decisions for equipment vendors in the recent past, so they know the issues vendors face now, as well as those they will face in the future. Personal Computing is one of seven programs that the Gartner Group offers; Videotex, Office Information Systems, Telecommunications Service Strategies, Industry Service, Large and Small Computer Systems are the other topics to which clients may subscribe.

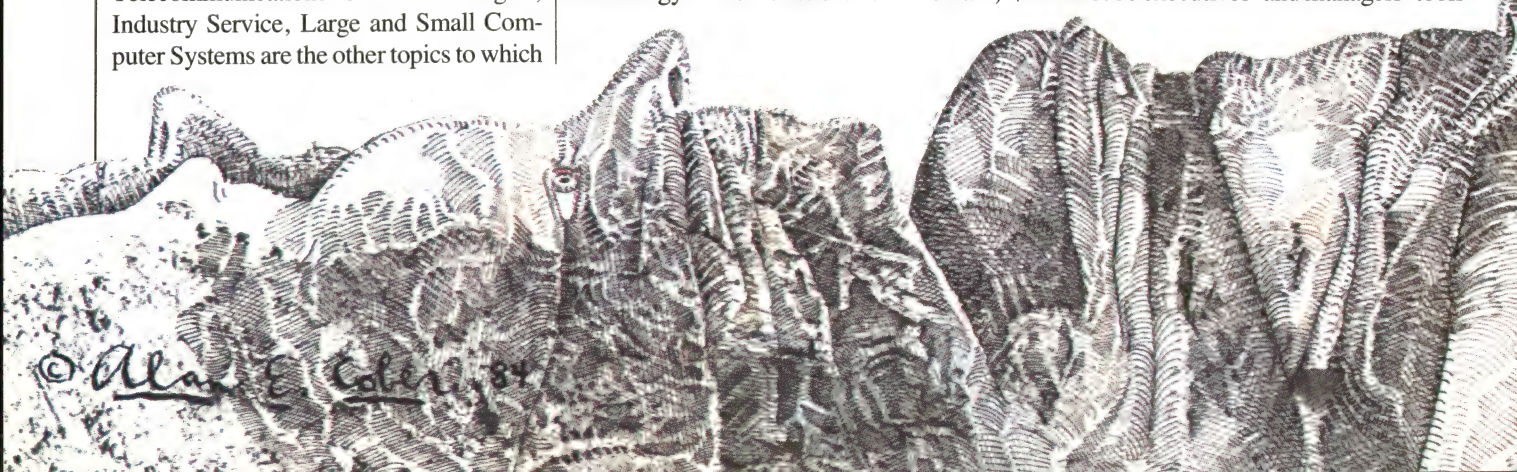
> The progression of technology and common sense point to the integration of multiple functions into a single device.

What does the future hold for personal computers? "Well," says Dick Imershein, corporate vice president of research, "there will be no more personal computers." Imershein takes obvious pleasure in watching reactions to this startling statement, but his intention is to distinguish between personal computing functions and what we know of as the personal computer in terms of hardware. In today's parlance, *personal computer* and *microcomputer* mean the same thing. But for tomorrow, Imershein forecasts machines incorporating multiple micros. The present generation of microcomputers will become obsolete and be replaced by more sophisticated products just as surely as the Model T gave way to automobiles with greater power and sophistication. "What we're really talking about," Imershein explains, "is the personal computing function: The ability for individuals to have at their work places—at home or in the office—the ability to increase productivity through the use of microcomputer technology. The functions will remain, but the boxes that we know as personal computers will be gone."

### Desk of the Future

On the desk of today's business professional you might find a telephone, a PC, a terminal to the corporate mainframe, and perhaps a tape recorder or transcription machine. The progression of technology, economics, and common sense point to the integration of these multiple functions into a single device. The convergence of new technologies like voice response, electronic imaging, and data retrieval will be a gradual process, but multifunction devices are already being introduced into the marketplace. The new IBM 3270 PC, which acts as both a micro and a terminal to a mainframe, is one example. Gartner Group and the industry that it analyzes refer generically to this new generation of high-tech business tools as "workstations."

The evolution from the general-purpose microcomputer of today to the multifunction workstation of tomorrow will culminate in fully integrated devices that will combine a variety of present standalone technologies: analog voice transmission (telephones), digital transmission (telecommunications), imaging (facsimile), and personal computing. The binding "glue" and emerging user interface, according to Gartner Group, will be artificial intelligence (AI) in the form of voice response and recognition. The physical packaging of this integrated workstation will be small enough to sit on a desk, even a secretary's desk. These workstations will not be executives' and managers' tools



only; they will be standard issue for everyone in the company.

Imershein describes the scenario: "When you move into an office, the office manager will look at your job title and configure a particular system for you. You'll go down to the stock room and an employee will test it, hand it to you, and say 'Here, take this back and plug it in.' What you plug in may be different from what the person in the adjoining office plugs in." Imershein thinks that workstations will be modular, with a variety of display devices, keyboards, communications, and other functions that users will be able to mix and match. Workers who process a great deal of text might get flat monochrome screens that can display multiple pages and keyboards designed for efficient text processing. People who work with graphics might get the same central component but with high-resolution bit-mapped color screens. "Users will have a plethora of components from which they can pick and choose and assemble," says Imershein.

## IBM Watching

Because IBM and its products dominate the marketplace, keeping an eye on that company is one of the key focuses of Gartner Group. The group's reputation in business and trade publications as the leading "IBM watcher" is due to insightful analysis by a professional staff, many of whom worked for Big Blue before coming to Gartner Group. Imershein spent more than 30 years with IBM. His most recent position there was in commercial analysis, evaluating competitors' products against IBM's own.

IBM competitors, both compatible and noncompatible, live in the giant's shadow. Compatibles face a particularly perilous existence. Jack Karp, director of Gartner Group's Personal Computing service, believes that once IBM solves its delivery schedule problems and announces its next round of price cuts, the compatibles will be severely squeezed. Why buy hardware from a company with an unknown reliability factor? Says Imershein, "I'm not sure that even vendors with good products can overcome the fear, uncertainty, and doubt that IBM causes in the marketplace."

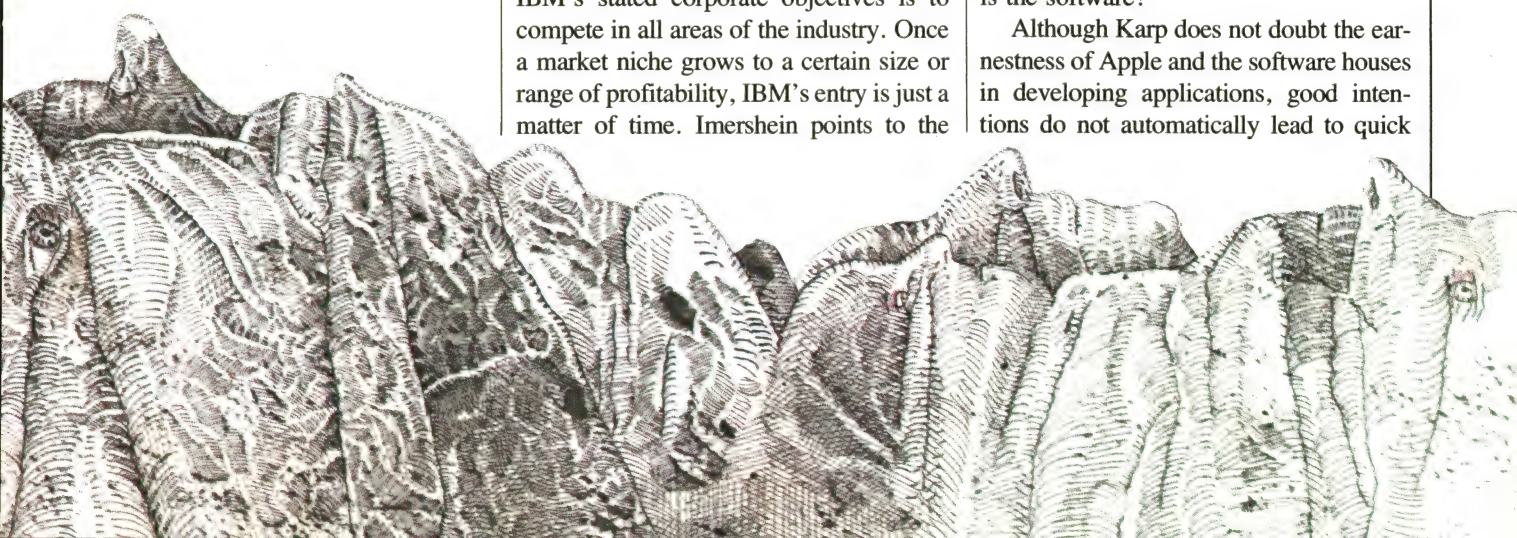
Gartner Group analysts, like many information industry watchers, feel that Big Blue has an array of products ready for manufacturing that it will introduce when the market is ripe, including lighter units—perhaps not true portables, but what Imershein calls "luggables." One of IBM's stated corporate objectives is to compete in all areas of the industry. Once a market niche grows to a certain size or range of profitability, IBM's entry is just a matter of time. Imershein points to the Independent Business Units (IBUs), which are small entrepreneurial start-up companies that belong to IBM but operate outside the bureaucratic framework. They are shielded from IBM's massive corporate hierarchy but are backed by its enormous financial, technical, and manufacturing resources. IBUs have accomplished with distinction their mission of competing swiftly in growing, profitable, nontraditional industry markets. The PC itself was born in such an IBU, which was recently incorporated into the mainstream Entry Systems Division.

> Once IBM announces its next round of price cuts, the compatibles will be severely squeezed.

IBM presents a different challenge to noncompatibles: persuading software manufacturers to produce applications for them. Apple's Macintosh is a prime example. Karp is enthusiastic about the attributes of the machine itself. "Wait until you see the resolution on the screen," he marvels. "If I could go out tomorrow and buy *1-2-3* on a Macintosh, I would do it. I have an IBM PC on order, but I would chuck it in a second."

But the key word here is *if*. When it introduced the Macintosh, Apple announced that 150 major software vendors, including Lotus, Software Publishing Corporation and MicroPro had agreed to provide applications for the machine. Software luminaries like Mitchell Kapor and Bill Gates appeared on promotional materials to demonstrate their commitment. But Karp is wary. "I heard the same thing about Apple's Lisa. A hundred software vendors had been signed up. Where is the software?"

Although Karp does not doubt the earnestness of Apple and the software houses in developing applications, good intentions do not automatically lead to quick



results. Software developers welcome new entries in the hardware arena; the more machines that can run their programs, the more potential for sales. Strategically, these developers need to become less dependent on IBM. But Karp points out a number of signs indicating that Macintosh applications may not be delivered in the early months critical to the machine's success. Lotus is already late with *1-2-3*'s followup, *Symphony,* and VisiCorp is late with *Visi On*. IBM is introducing new products every several months, and, says Karp, "not too many software houses can afford to fall too far behind with IBM. I'm not denying that these people have made a commitment to Apple to produce software. I guess I'm questioning the time frame."

## Clear Skies

However, Gartner Group does not forecast certain gloom and doom for noncompatibles simply because these manufacturers haven't jumped on the IBM bandwagon. The wildfire success of IBM in the microcomputer marketplace does not mean that every workstation must run MS-DOS. Rather, Gartner Group advocates that buyers remember the fundamental adage: Know your requirements. "The only reason to be compatible," stresses Imershein, "is to have access to the software." If a machine offers the productivity tools a company needs with added attractions like a lower price or a better interface, compatibility isn't an issue. For the user, a micro's potential to increase productivity should be the criteria. At higher levels in an organization, other factors in the acquisition decision become important—serviceability, training, and the growing need to interconnect, particularly with the corporate mainframe.

The abundance of approaches in hardware and software design, while a nightmare for buyers, accurately reflects the uneven adaptation of new technologies by society. User interfaces are a prime example. Manufacturers of mice, touch screens, and pads are claiming superiority to keyboards. Will one of them become the new standard or will they all follow the path of light pens to become interesting but minor variations? The problem is, says Karp, "although we know intuitively that Apple's Lisa is a better interface than CP/M or MS-DOS, ultimately we don't know what a good human interface is." Gartner Group believes that IBM, which has been criticized for not providing leadership, is watching the market for favorable and unfavorable reactions. Only after it is convinced that the market acceptance potential is there will IBM commit its massive resources to a product.

> VisiCorp and Microsoft are corporate gladiators in the struggle for supremacy in user interfaces.

The software industry is also seeking better user interfaces. The hot ticket today is environmental software—operating systems that feature multitasking, integrated applications and, most visually dramatic of all, windows. A windowing environment usually divides the screen into different boxes, each a mini-display for a different application such as a word processing program or a spreadsheet. By moving the cursor from box to box, you jump from the middle of one application into another. The process, Gartner Group analysts agree, simulates a business person's desk, which typically is covered with memos, phone messages, and reports, the flotsam and jetsam of day-to-day business. Windowing allows you to analyze data using a spreadsheet application, jump to a graphics generation application to produce a pie chart for dramatic illustration, and then jump to a word processing window to write a memo announcing your findings. As you move from one window into another, the new window enlarges and overlaps the prior ones. The effect is quite startling.

## Interface Face-Off

The major players like VisiCorp and Microsoft are corporate gladiators in the struggle for supremacy in user interfaces. The designers and programmers in each company are working at a frenzied pace and the marketing heads are drawing up battle plans. This is big league stuff, even for the computer industry in which each week brings new products that claim they will set the world on its heels. Environment software is a major step on the road to the integrated workstations envisioned by Gartner Group, but it must be a part of a package that's attractive as a whole.



Apple's Lisa was an early revolution in environmental software that did not succeed, primarily due to high price and lack of available software. The Macintosh, which features many of the Lisa's best features, is priced attractively but no deliverable software is yet available.

Imershein agrees that software availability is the key to the success of the Macintosh or any new micro. But he also sees some problems that may impede immediate acceptance by the established micro community. "Twenty years ago when the CRT was first available, we were taught that we could do only one thing at a time," Imershein reflects. "And for 20 years we've been looking at one thing at a time. Windowing is closer to the way we really work, though it's not the way we've been educated." The experienced workstation user of today may find the change unsettling. But computer-literate students, who are the business professionals of tomorrow, have no such imprint, and the major vendors are focusing their resources on getting to them first.

Although the office is still the biggest battleground, schools are developing into a second front. While selling to educational institutions is not as profitable as selling to businesses, users who are acclimated to a manufacturer's products at an early age will be more inclined to use them later on in business. "Apple is moving with lightning speed here," says Karp, referring to Apple's agreement to sell several thousand Macintoshes to prominent universities. "Once you're on a Macintosh or Lisa, you're not going to want to go to a user interface that's less friendly." IBM is taking action, he notes, by making agreements with several universities and schools. Its elite sales force is rewarded with additional bonuses for placements in educational institutions.

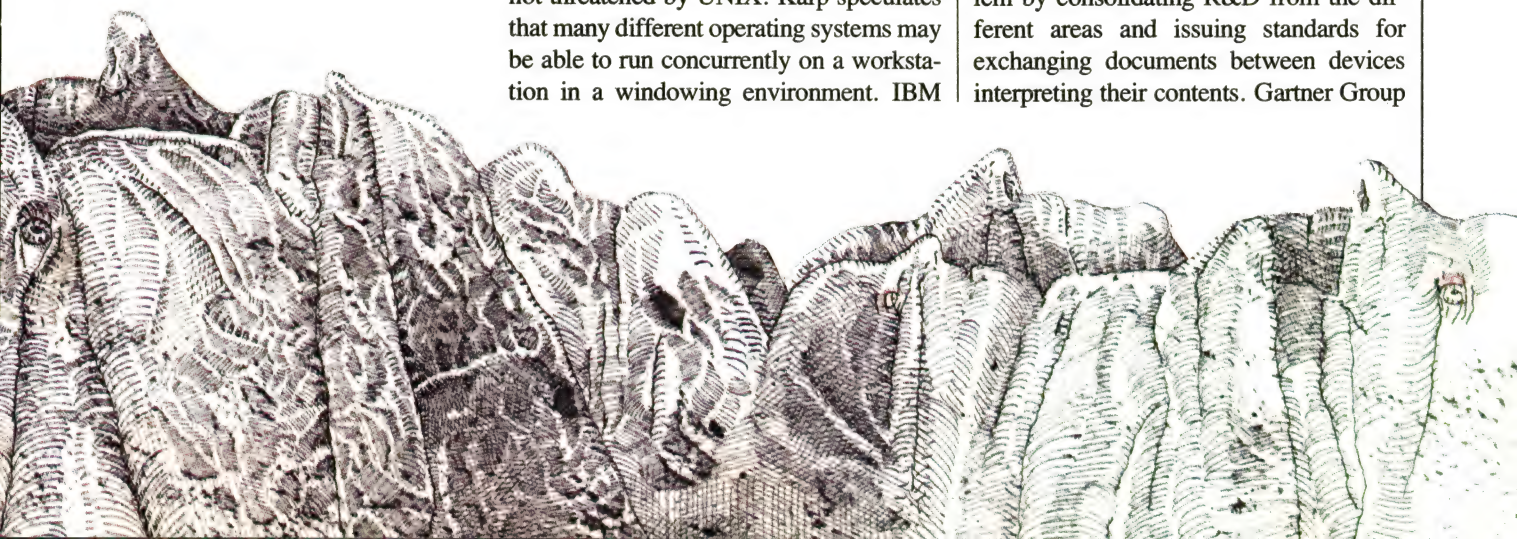
While major software advances are looming on the horizon, Gartner Group foresees no revolutionary hardware products in the near term.

Another hot software issue involves UNIX. This multitasking operating system offers portability; application code written in UNIX can be adopted for a variety of machines from micros to mainframes. This enormous hardware base spells almost unlimited potential for software vendors. UNIX was developed by Bell Labs, part of AT&T. Gartner Group experts believe that AT&T will become a major force in the computer field and that its ace is UNIX, but they also believe that MS-DOS and its broad applications are not threatened by UNIX. Karp speculates that many different operating systems may be able to run concurrently on a workstation in a windowing environment. IBM already has expertise in this field with its Virtual Machine (VM) software for System/370-architecture computers. The software "guests" other operating systems under the VM umbrella operating system, partitioning out the machine resources to make each guest operating system think it has control of the entire system.

## No Hardware on the Horizon

While major software advances are looming on the horizon, Gartner Group sees no revolutionary hardware products approaching. Instead, existing hardware will gain additional capabilities such as multifunction boards and perhaps phone patches that allow micros to act as voice transmission devices.

An area that may make great strides in the near future is communications. IBM's situation once again reflects that of the industry in general. Up until a few years ago, IBM had several divisions, each with its own R&D, manufacturing, and marketing, and each concentrated on a different segment of the industry. Depending on which division called on your firm, you could be offered a variety of word processing devices from the standalone Displaywriter to the shared logic 5520 system. Products were directed at specific office needs that they addressed successfully. What was missing was a unifying communications system. One kind of machine could not talk to another. Only recently has IBM begun to tackle this thorny problem by consolidating R&D from the different areas and issuing standards for exchanging documents between devices interpreting their contents. Gartner Group



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cites Document Interchange Architecture (DIA) and Document Content Architecture (DCA) as proof that IBM recognizes the need to link the various parts of the office.

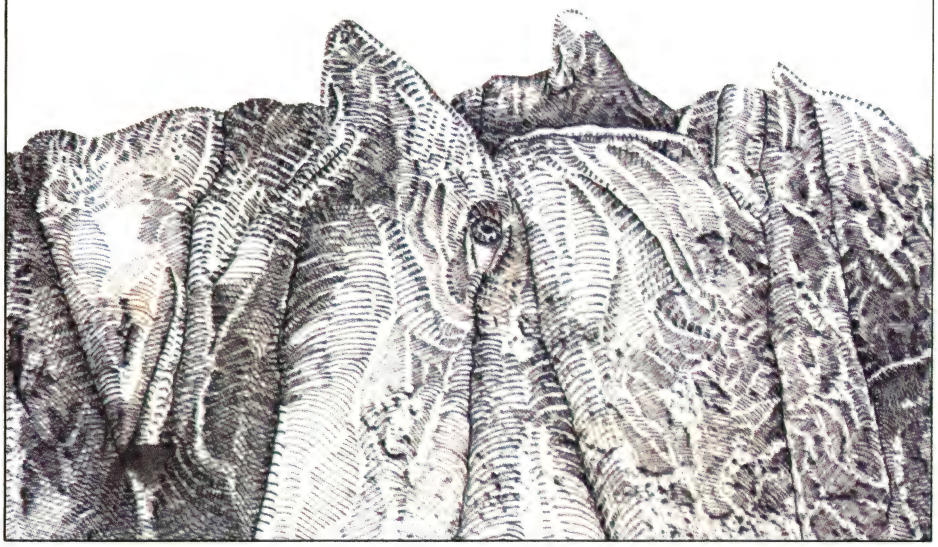
While major advances are expected to close communications gaps, Imershein predicts that other hardware announcements will be improvements on existing products. He foresees developments in ink-jet printing, which actually sprays characters onto a page. Color ink-jet printers will become better and less expensive, offering higher speeds than today's letter quality printer and improved print quality. These devices, Imershein believes, will come from Japan.

## Printing in Japanese

What discussion of the future of microcomputers would be complete without mentioning the role of the Japanese? Gartner Group analysts see the seeds of tomorrow in today's products; notes Imershein, "The Japanese already own the low-cost printing market. They are established there and the United States cannot compete." Similarly, displays and chips are manufactured in growing numbers in the Far East. The real question, Imershein believes, is when the Japanese will be able to sell a complete product. It is not for lack of product; NEC, Fujitsu, and several other Japanese companies already have micros in stores. Solving the problems of distribution, sales and service is perhaps a more formidable task than creating the hardware itself, especially when such areas are the chief strengths of American vendors, primarily IBM.

"Inevitability" is a recurring term at Gartner Group. The speed with which not only technology but *affordable* technology is approaching shows no sign of slowing down. The boom in information communications may be tumultuous, but it is certainly not directionless. The future is, of course, inevitable, but Gartner Group believes that with careful analysis of technological developments and a solid understanding of today's business environment, the future is also clear. ■

Imershein predicts that color ink-jet printers will become better and less expensive, offering higher speeds than today's letter quality printer.



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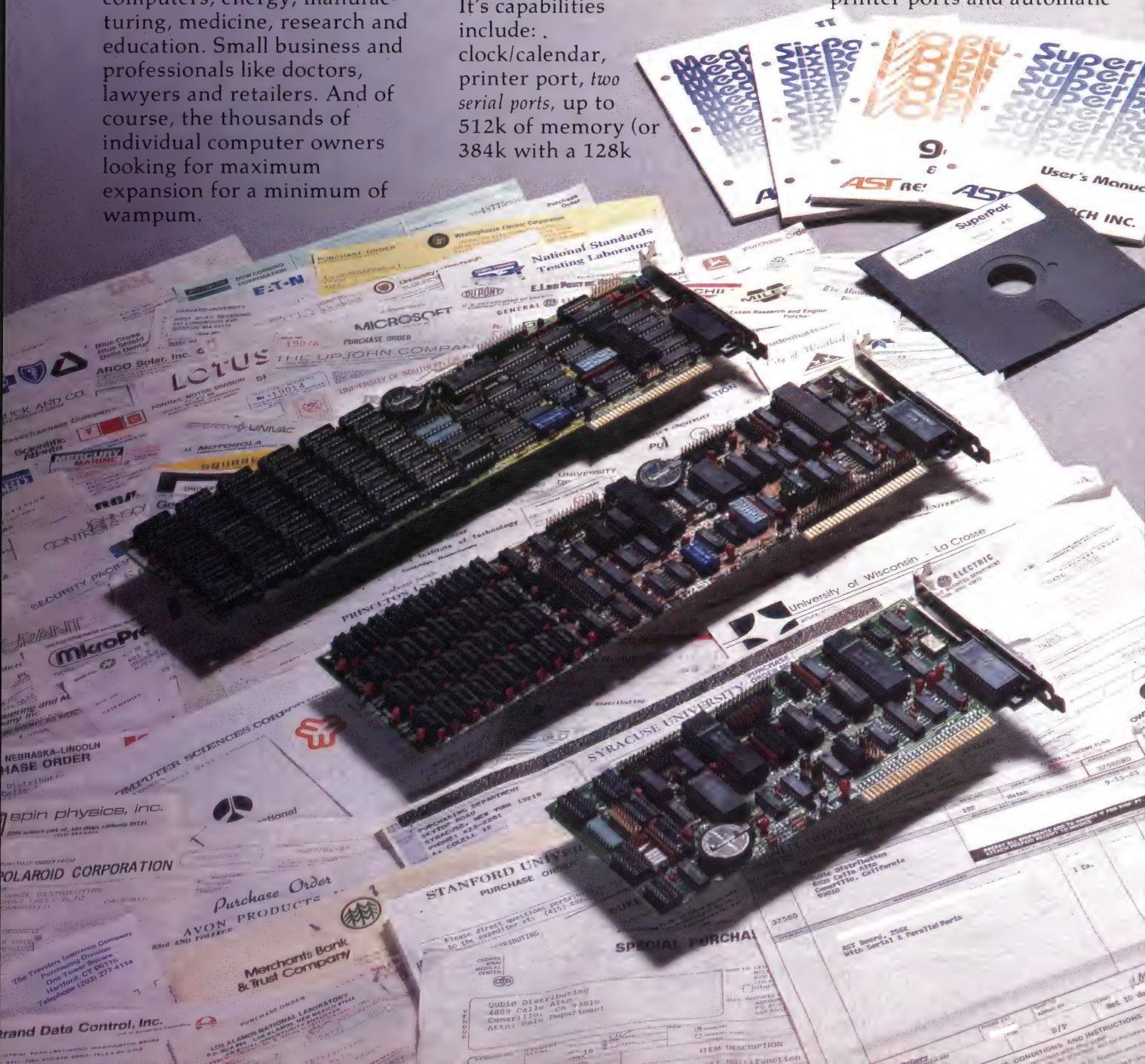
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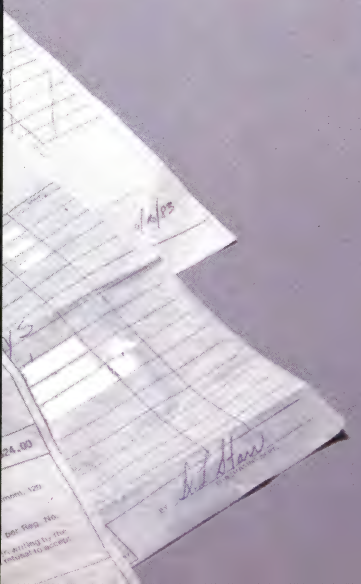
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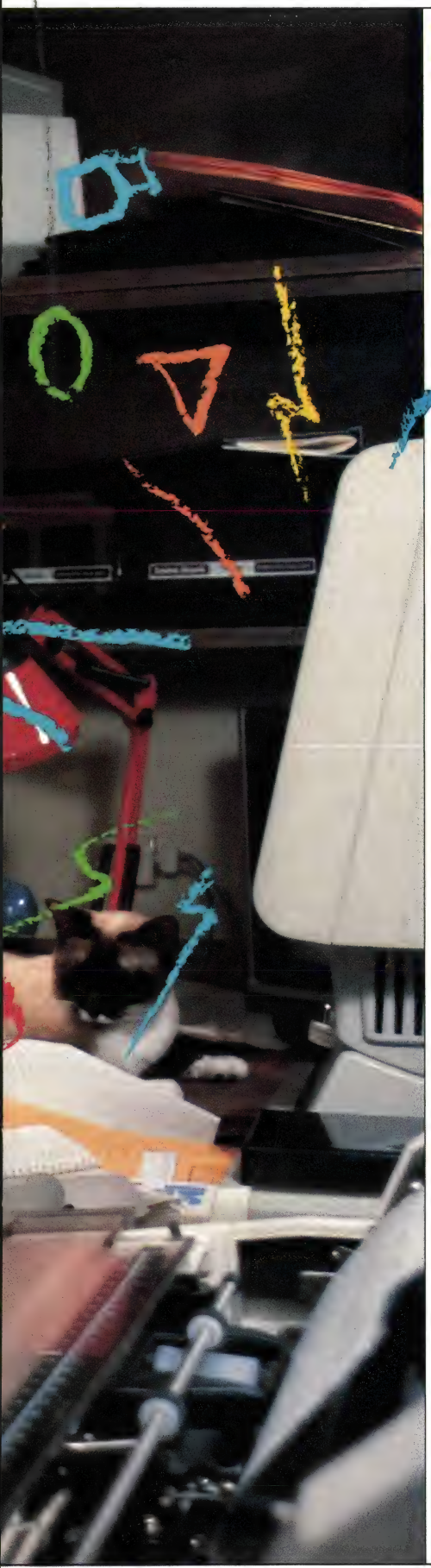
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# Bank Street Writer Is a Family Affair

## A mother and daughter writing team reviews a word processing program. Mother Lindsy, a PC contributing editor, gets the first word.

Unlike Cabbage Patch dolls, Froot Loops, or MTV, *Bank Street Writer* is a kids' product that even a parent could love. Designed in conjunction with the Bank Street College of Education in New York City (which helped to develop the Head Start program in the Sixties) and tested on elementary school children at the Bank Street School, it aspires to be a nonintimidating, easy-to-learn, hard-to-forget word processing program for young users. Despite a few flaws, it succeeds—and I suspect it will be grabbed up by legions of adults too.

It is also a surprisingly multifeatured program, considering its ease of use. It includes such sophisticated touches as global search and replace, function key macros, onscreen boldface and underline, multiple file printing, and the ability to undo block moves and erases, to name just a few. At the same time, the program is designed so that new users—who probably don't need to take advantage of the more advanced features right away—don't even have to think about them.

*Bank Street Writer* comes with a 55-page paperbound manual and an on-disk tutorial. (If you've ever used a word processing program before, you won't need either one.) The program is copy-protected, which means that it can't be loaded onto a hard disk, but you do receive two copies. If *Bank Street Writer* ever fails to boot up or otherwise perform, use your extra copy and mail the defective disk back to Broderbund for a replacement.

### Klutz-Proofed

A relatively klutz-proof installation program copies BASIC and PC-DOS files from your DOS disk onto the *Bank Street*

*Mother Lindsy and daughter Sadie practice Bank Street Writer at home.*

Photograph: Roberto Sandoval; Illustration: Tom Stvan

*Writer* disk. (You need BASIC to run the tutorial.) Once you have performed this installation, you need never trifle with your DOS disk again, since *Bank Street Writer* includes its own self-contained, easy-to-use versions of most of the commonly used internal and external operating system commands such as DIR, COPY, DISKCOPY, CHKDSK, RENAME, and FORMAT.

To get started, you simply boot the program, type the letter T while it's loading, and then follow the onscreen instructions to remove your disk from the drive and flip it over. The tutorial on the other side of the disk includes seven lessons: "Getting Started," "Moving the Cursor; Adding and Deleting Text," "Using the Special Keys," "Erasing Blocks of Text," "Moving Blocks of Text," "Copying Blocks of Text," and "Finding and Replacing Words and Phrases," plus an overview of other major features not covered in the lessons. Except for the fact that you can't move back a page to see what you've just learned, the tutorial is logical and clear. (I do wish, though, that the writers had come up with something other than "The Gettysburg Address" for editing practice. I must have edited that speech in a half dozen different tutorials by now—whereas in this case the words to, say, Michael Jackson's *Thriller* might be more appropriate.)

When you actually start *Bank Street Writer,* the program lands you in a square that takes up most of your screen—an electronic clean slate. Onscreen prompts tell you what drive you're in, which keys move the cursor, and which keys delete. (The Del key deletes the text ahead of it and the gray backspace key deletes the text in back of it. Unfortunately, only the Del key deletes the letter the cursor is actually on, a possible source of confusion.)



In the writing mode, you can't tell from your screen what the printed copy will look like, a disadvantage for those used to typewriters.

***Bank Street Writer***
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Another onscreen prompt tells you to "Press Alt-K for Keys." You get a picture of the IBM keyboard with the major *Bank Street Writer* keys (such as the tab and Return keys) specially marked. Then press the Return key and you'll see a list of more than a dozen other key and combination key commands. All of these are as logical as anyone could ask for. Compare *WordStar*'s inexplicably dubbed command for underlining, Ctrl-PS, with *Bank Street Writer*'s perfectly sensible Alt-U. (Unfortunately, the program underlines the spaces between words in a block of underlined text unless you key in Alt-U before and after each word.)

Other Alt commands let you boldface (B), center (C), and indent (I). Alt-S lets you check how much space is left in your file, measured in how many more words you can type. This feature can serve as a rough word-counter. Files seem limited to about 30K, which ought to be enough for most home uses. Ctrl combined with the left and right arrow keys moves you to the start or end of the line, and you can use Home and End to go to the top and bottom of a file.

## Escape into Editing

*Bank Street Writer* is divided into two modes, one for writing and one for editing. In the writing mode, which you automatically enter when the program starts, you'll see an onscreen prompt telling you to "Press Esc for Editing Functions." Press the Escape key and the top of your screen will then look like Figure 1.

You select from among these functions by pressing the tab key and advancing progressively through the upper and then the lower rows. When you land on the function you want to use, press Return. If you want to move a little faster, you can use shift-tab to move backwards or the space bar to move instantly between the upper and lower rows. Once you finish the editing chore you've selected, you have to press the Esc key to return to the writing mode. This two-mode system may make the program more manageable for children and other new users, and it's easy to remember to hit Esc to go into the edit mode, since all the commands you need to use are there. But I found it difficult to remember to officially leap back into the writing mode. Instead, I just started typing on the inviting clean-slate screen, and nothing happened—except a rude little beep that nattered at me until I noticed the onscreen prompt and hit the Escape key.

Within the writing mode, you can't tell from your screen what the final printed copy will look like, a possible disadvantage for users who are used to typewriters. To be fair, very few word processors have what-you-see-is-what-you-get capability. The editing mode, however, is organized with enormous attention to novices:

• SAVE first asks you if you want to save all of your text. If you don't, you can place your cursor at the top and bottom of the block of text you do want saved. You're then asked if you want to see a directory of the files on your disk and an estimate of how much space is left on your disk. Unlike the PC-DOS CHKDSK command, which tells you how much room you have in bytes, *Bank Street Writer* tells you how many more words you can write. If your file has been previously saved, you're asked if you want to save it under its previous name or whether you want to overwrite the previous file.

The program, in other words, holds your hand every inch of the way and makes sure you know what you're doing. This is undoubtedly a blessing for new users, but it takes its toll in keystrokes. The shortest *Bank Street Writer* equivalent of the *WordStar* command to save and return to the file, Ctrl-KS, would be Esc, Enter, y, y, y, Esc.

You can also save your file with a three-letter password so that no one else can retrieve it. (Actually, anyone who knows how to use the program can—but more about that later.) The password concept is a sort of digital diary key—a nice touch for kids.

• ERASE asks you to place your cursor at the beginning and end of the block you want erased. The program then highlights the block (which can be up to 15 lines long) and asks you if you're sure before it goes ahead.

• MOVE similarly highlights a block you've chosen, has you move your cursor to your desired location, then asks if you're sure you want to move.

• COPY also highlights a block and copies it to a new location in your file after asking if you're sure you want to copy it.

• PRINT asks you a series of questions and has a series of default answers, thus allowing you to simply continue pressing the Return key if you're performing a routine print job. This is one example of the program's successful blending of power and simplicity. First you're asked if you

# A Kid's-Eye View

## Bank Street Writer was developed with kids like Sadie in mind. This WordStar veteran finds it a perfect fit.



*Sadie Van Gelder*

The first word processor I ever used was the one at my father's office. I was introduced to it when I was 7 years old—6 years ago. Spending every other Sunday with a VDT, I learned to somewhat manipulate the controls for my purposes. Then, when I was 11, my mom got an IBM PC and with it a word processor called *WordStar*. I had to learn more complicated functions and a lot of commands. We had to keep our manual hanging above the computer so we could keep the commands close by. Now, 2 years later, we have been introduced to *Bank Street Writer*. It's a word processor for kids—but a lot of adults who are friends of my mother's would rather learn *Bank Street Writer* than "adult" word processors.

Actually, I have to rephrase the previous sentence—there's no such thing as learning *Bank Street Writer*: All the commands are on your screen. When we got *WordStar*, I couldn't use it for a few weeks because I had to learn the commands. When we got *Bank Street Writer*, I wrote a letter the first day.

You can change the program to suit your own purposes: by deciding whether to run it on your monochrome or graphics monitor, by deciding your line spacing, by deciding the shape of the cursor, and more. You can also use the 10 function keys to carry out whatever command you want. But the best part of all is that there are almost no commands to memorize. Aha! *Almost* no commands to memorize, you say. But don't be fooled. Whenever you want, you can get a list of commands used and a picture of your keyboard showing you the keys most frequently used! No need to type with one hand and hold your manual with the other. And the commands are simple and easy to memorize (for example, boldface is Alt B and underlining is Alt U).

*(continued)*

*(A KID'S-EYE VIEW continued)*

This program was first made especially for kids, so that is why all the commands are on the screen and the whole program is so easy to use. But for this reason, a lot of adults who are generally distrustful of computers, or just learning about them, or even adults familiar with other word processors, will find *Bank Street Writer* a good program. I think this would be a good word processor for a family because both an adult and a kid could use it. It's especially good for a family that has just gotten a computer.

One thing I don't like about the program, however, is that when you turn it on, you automatically go into a clear working space. If you want to go back to something you had been doing before, you have to bring it into your work space. In *WordStar,* you are faced with a menu when you get started. You can type in the name of an old file and then go into that file. In *Bank Street Writer,* you have to press the Esc key while you are in a new work file (which you are automatically placed in when the program begins) and *then* use the Retrieve function to bring your old story into your new work space. Then you are faced with questions like, "Would You Like to See a Catalog of Files on the Disk?" I think it would be easier if, in the beginning, you got a menu and you could use Retrieve to get into your old story immediately. This isn't really that much of a problem, but it's annoying to me.

Another aspect of the program that I don't like is that a password can only be three letters long. I guess this *does* make some sense, because it might be hard to remember a long password, but I wish there wasn't a limit to how long the password could be. Anyway, if you do forget your password for a certain file, you can go into utility program and see a list of all your files with their passwords. I do, however, like the idea of having a password protect your files.

Another thing I don't like is that when you set for double spacing, it doesn't show up on the screen as double-spaced—you can only see the double spacing when you print out. I don't know why it does this, because unlike another word processor I've used, it shows right on your screen when you have done underlining or boldfacing, which is something I like.

### Taking a Cue from Games

The whole key to computers nowadays is that they're user-friendly. It's pretty common to make a user-friendly game (i.e., letting the user decide what keys they want to use for certain controls), but *Bank Street Writer* is the first user-friendly word processor I've ever encountered. If more people decide to make their software as user-friendly as *Bank Street Writer,* computers will generally stop producing so much "oh my god, did I mess up?" anxiety. ■

*Sadie Van Gelder is a free-lance writer who has published articles on computers in* Enter, *a computer magazine for kids, and* PCjr. Magazine.

want to print all of your text, and then if you want to print your current text as a continuation of your previous print job (this is useful if you want to link files). You can number your pages beginning with 1 or not, insert a short heading or footer, and stop your printing either at the very bottom of your last page or exactly where you stopped printing on the page.

You can also see onscreen where each printed page will begin and end (and edit out widows or orphans, if you like), and you can print to screen or disk as well as to your printer. After printing out, you're asked if you want to print another copy.



Bank Street Writer would be a good word processor for a family, especially for one that has just gotten a computer, because both an adult and a kid could use it.

- CLEAR asks you if you want to erase your text, which most people would interpret as a ticket to no-RAMs-land. It then asks if you want to clear all of your text and whether you're sure. What the clear command actually does, however, is simply clear the screen. If you've already saved your file, it will remain saved. If you haven't saved, the program tells you you haven't and you then have the choice of either saving or erasing. Since the command operates differently on different files, it might be confusing at first.
- RETRIEVE asks you if you want to see a list of files. You type in the name of the file you want and its password (or the Return key if it doesn't have one).

• UNERASE lets you bring back a block of text you've just wiped out with the ERASE command. This is a wonderful feature for first time users, but since it exists, I wish the programmers had left out the "are you sure?" in the erase function. Hand-holding is one thing, but this is more like wearing a belt and suspenders at the same time.

• MOVEBACK lets you move back a block of text you've just repositioned with the move command (after being asked if you're absolutely positively certain you want to). More suspenders here.

• REPLACE asks you for a word or words you want to find in your text. You can either simply find the words by pressing the return key, or you can automatically replace them with other words. You can do a whole word find or a partial word find, and you can find words with exactly the same case (upper or lower) as your target words, if you want. If you don't know, the Replace function gives you the most common defaults. When you come to your target words in the text, you're asked if you want to continue looking.

• FORMAT lets you easily set tabs; change line spacing (single, double, or triple space, but only one type of spacing per document); set left, right, top, and bottom margins; decide whether to pause between pages when printing; set the location of headings and footers; set page numbers (top of page, bottom, or none), their exact location (left, center, right, or alternating left and right), and even whether they're printed as Page 1, 1, or -1-. Perhaps the only popular printing format not supported by *Bank Street Writer* is justified type.

The format function also lets you choose the logged disk drive, whether you want a block-shaped or underline-shaped cursor, and whether you want carriage returns to show on your screen. You can also install your type of monitor and decide how many columns you want displayed on your screen. The program makes good use of color monitors. However, even though text can be displayed at 40 columns, *Bank Street Writer* won't run on a television set—a drawback that will undoubtedly lose it a certain amount of business among PC*jr* owners. Finally, the format function lets you install your printer, with defaults for the parallel printers most commonly used with the IBM.

• OTHER is an umbrella for a number of miscellaneous commands. You can delete whole files (naturally, the program asks you if you're sure you want to), rename files, print a list of all the files on a disk on your printer (handy for indexing if you've got a large floppy library), format a disk (the program warns you that formatting erases old files), exit to DOS, or "quit to utility."

| | | | | | |
|---|---|---|---|---|---|
| SAVE | ERASE | MOVE | COPY | PRINT | CLEAR |
| RETRIEVE | UNERASE | MOVEBACK | REPLACE | FORMAT | OTHER |

**Figure 1:** *When you switch from writing to editing mode, these functions appear on your screen. You move the cursor through them to select the one you want.*

The utility program turns out to be still another umbrella of miscellaneous commands: copying whole files, copying whole disks, adding line feeds to a whole file (sometimes necessary for printing downloaded files), printing multiple files, and displaying a catalog of all your files with their passwords (see—your kids can't *really* hide their text from you after all).

Finally, you can redefine the PC's 10 functions keys through the utility program. I tried to rig *Bank Street Writer*—as I've rigged *WordPerfect* and *WordStar* with the *Prokey* macro utility program—to perform long, tedious operational chores, such as saving a file by copying it from a RAMdisk to a floppy disk, running a word count program and then reopening the file and positioning the cursor at the end of it. Unfortunately, *Bank Street Writer* can't handle such exotica, particularly not strings of commands involving the Esc key. What it *can* do is redefine keys to represent strings of letters—such as your own address for making automatic letterheads. It can also speed up the process of selecting a job from the editing menu. For instance, to access the "other" function, you'd normally have to press the tab key five times, the space bar, and then the return key. Instead, you could program one of the function keys to perform that entire group of keystrokes. Such speed freakery is more the mark of the experienced techno-junkie than the brand new user, but it's nice to know that the capability is there if you ever want it.

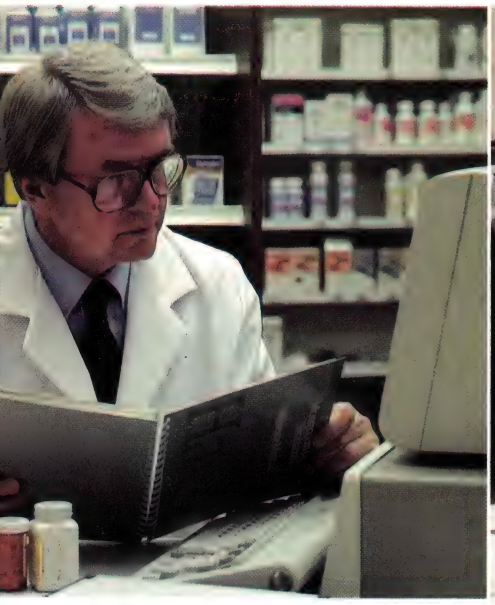
## The Man Behind the Writer

According to Franklin E. Smith, The man who designed the *Bank Street Writer,* the program was never meant to compete with $500 business word processors. "At the time it was created, everyone was trying to outdo each other by adding hundreds of new features," he said. "Our idea was to go in the other direction, and build something transparent." The program got its start when the Bank Street School received a foundation grant to test the efficacy of using computers to help children learn to write. The premise of the experiment was that children might become less frustrated and more creative if they didn't need to labor over new copies of their work every time they made an error. Unfortunately, all the commercial word processing programs that the testers looked at were too laborious themselves to test the premise. Smith, a consultant from Cambridge, Massachusetts, headed up the team designing a brand new program.

"The program was originally written for the Apple," Smith said, "and we had several design goals. First, the program had to work on a minimally configured machine—which meant 48K, one disk

# Your computer's telephone.

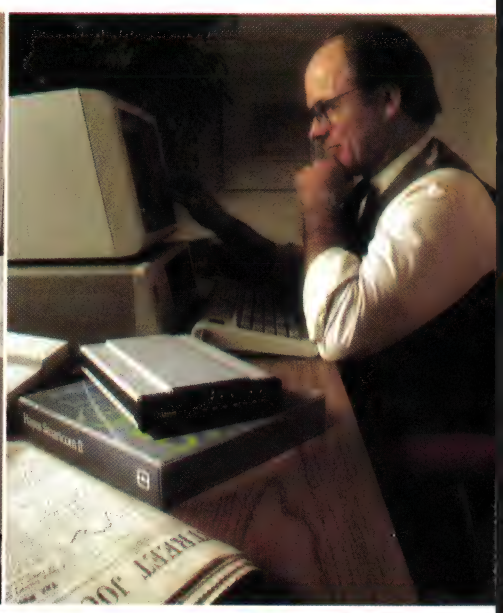
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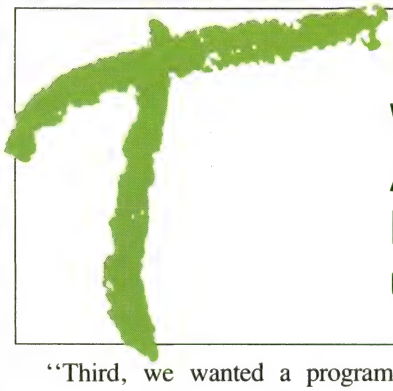
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## BANK STREET WRITER

drive, and a TV set. Second, needless to say, it had to be easy to use—not just something you could learn quickly, but something that you could learn, be away from for a few weeks, and then come back to and use without having to relearn it.

bestseller and was soon followed by Atari and Commodore 64 versions. Not surprisingly, the IBM version is superior to its cousins, combining the original design goal of simplicity with a lot of new muscle. "What we essentially did was put



The original Bank Street Writer was limited by the Apple's keyboard and by its inability to do both upper and lower case.

"Third, we wanted a program that didn't get in the way of the writing process. The best example is that when you boot up, you get a blank screen and you can just start writing. We paid a lot of attention to idiot-proofing the prompts, so you can't get lost wandering down alleys in the program. For instance, we always tried to think of what the most common uses were and we made them the defaults. As a result, we obviously made a very conscious trade-off between ease of use and a certain amount of functionality and power. This isn't a program for heavy-duty professional writers, and it's not supposed to be."

What would be ideal would be a more multileveled program. For instance, I wish it were possible to turn off the pesky "are you sure?" which quickly starts seeming about as transparent to the writing process as a dead elephant lodged in your disk drive. Such a program would probably require more than 64K, but the day isn't far off when 128K will be the standard minimum IBM configuration.

The original version of *Bank Street Writer* was also limited by the Apple's keyboard and its inability, in its lowest common denominator configuration, to do both upper and lower case. Nonetheless, when the Apple version was released in January 1983, it immediately became a

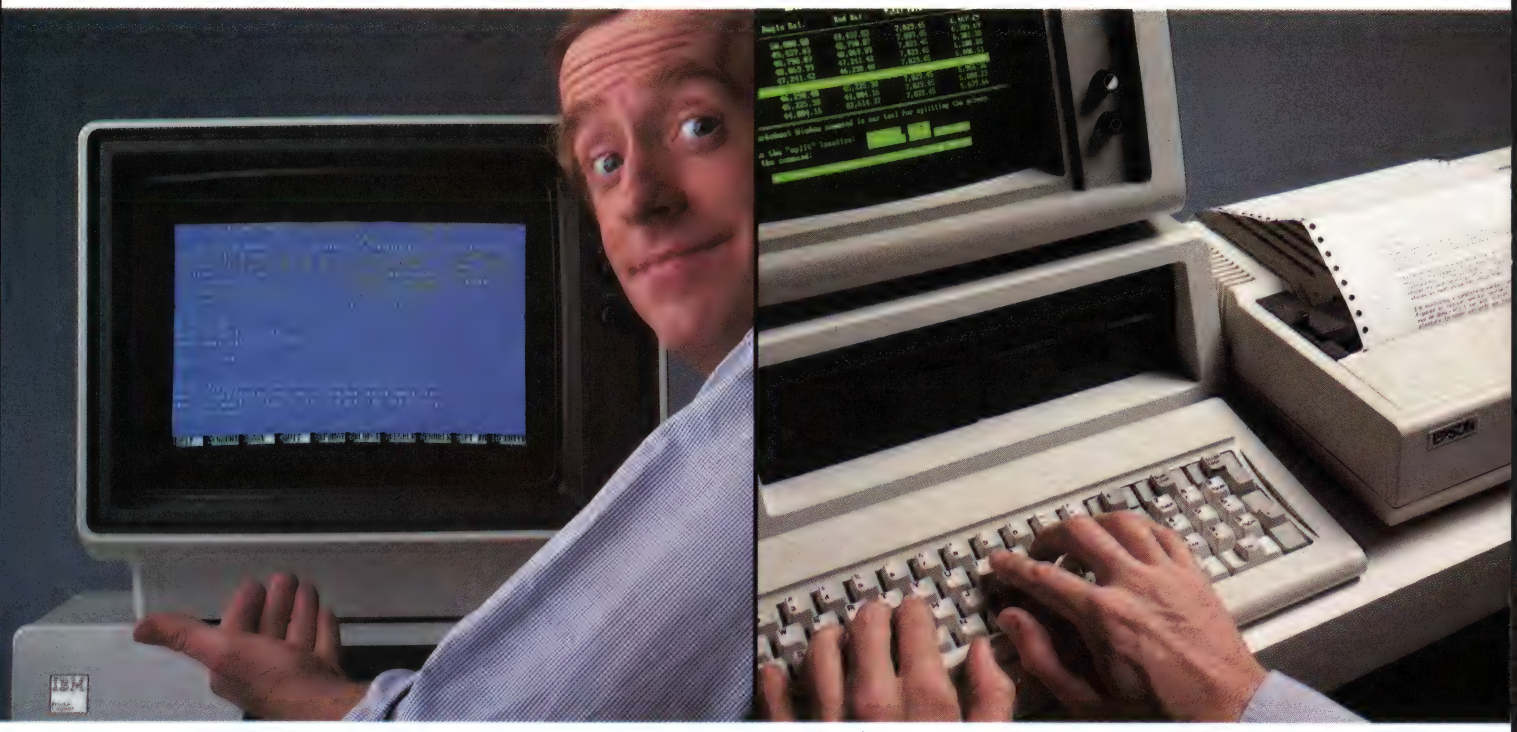
back in a lot of the features—like the search and replace option—that we had to leave out to fit into the Apple minimal configuration," Smith said. The IBM PC version also reaped the benefits of ongoing research and updates of the earlier versions.

### Working a Double Shift

Unlike Sierra On-Line's *HomeWord,* the official IBM word processing release for the PC*jr, Bank Street Writer* runs on both the PC*jr* and the PC—a real plus for people who own both machines.

At our house, the program has been a hit with 13-year-old Sadie (see adjacent story) and 10-year-old Miranda, but it's probably been a bigger hit with the numerous adults we know who are agonizing over buying a PC. Most of them are already overwhelmed by hardware, operating systems, and the very process of choosing and buying. They don't *want* extra complications at this point, and they blanch with horror when I proudly show off my debugged, *ProKey*ed, AST SuperDrive-driven *WordStar,* or even my *WordPerfect* that requires its own cribsheet templates over the keys to keep track of the commands. For new owners, even those who may move up to more complex word processing software, *Bank Street Writer* is an excellent investment. ■

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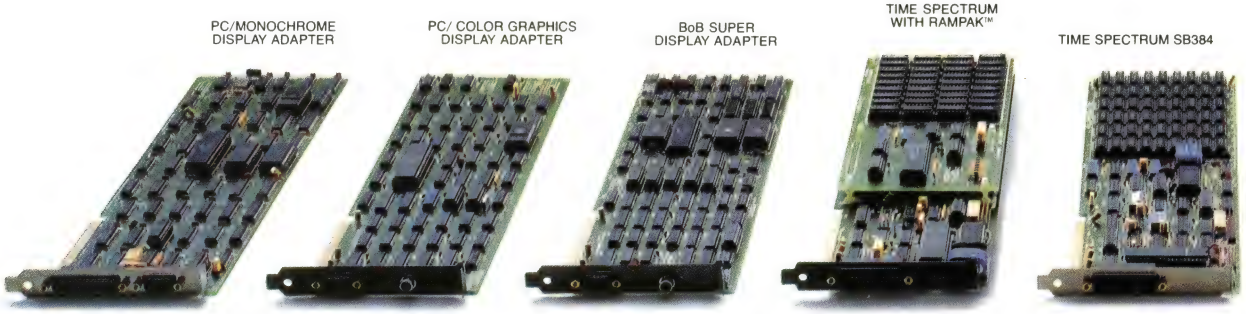
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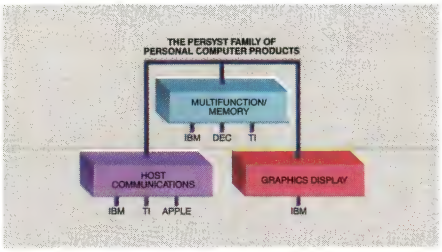
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```
17664    3-08-83   12:00p
560      2-02-84    7:22p
133      1-01-80   12:08a
4        2-16-84    1:34p
273      2-16-84    3:49a
631      2-16-84    3:56a
280      2-22-84   11:24a
172      2-24-84    5:46p
615      2-24-84    5:50p
563      3-01-84    2:25p
1018     3-02-84    9:06a
)     311296 bytes free
```

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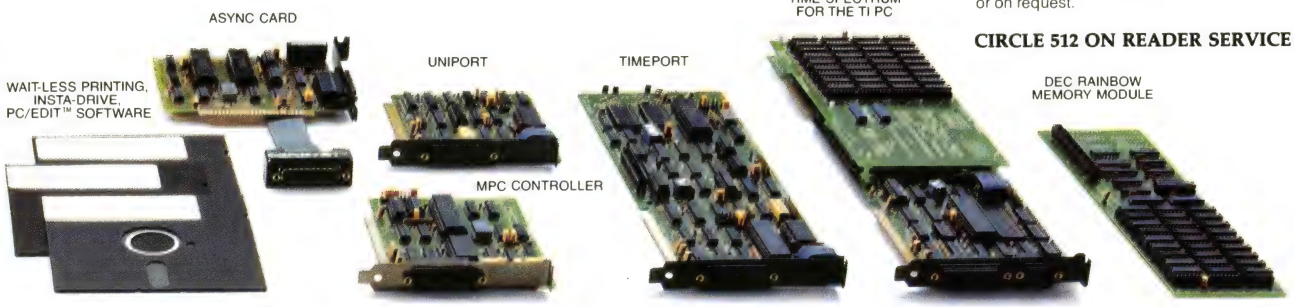
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Logo:
A

SPECIAL REPORT

JANE AND HAL LAMSTER

# Language For Grownups, Too

First created at MIT to teach children, Logo is a premier language for adults as well. *PC* now reviews how Logo has come of age.




Even computer languages come of age, and Logo is no exception. Originally designed as a teaching aid for children, Logo has been implemented in versions that will meet many of the more sophisticated programming needs of adults. At the same time, Logo has preserved its endearing simplicity and flexibility.

Simplicity of design and use was important to Logo's creator, MIT's Seymour Papert, for a very special reason: Logo was to be used primarily by children. Taking his cue from

the Swiss learning theorist Jean Piaget and inspired by what he had learned in the area of artificial intelligence (AI), Papert developed a tool to stretch and exercise young minds.

In the Logo environment, the child is given the computer as an experimental device. Papert understood that just as a pencil can be a child's tool for solving mathematical problems, composing poems, or simply doodling, so can a computer. Logo's special charm is that the user determines the direction, extent, and sophistication of the work—even if that user is only a child.

Logo promotes its creator's aim of cognitive development in two ways: First, it creates an environment where flexible problem-solving tools can break down large problems into smaller segments. These smaller segments can again be broken down into still more basic problems that can be studied, debugged, and solved. Individual solutions can then be reassembled into a solution to the larger problem. This general approach is applicable to all problem solving.

## Turtles Aren't Only for Kids

Logo's second and most visible innovation in the education of the young is the "turtle"—an enhanced cursor in the shape of a triangle. At some point in its development, the turtle changed from a small R2D2-like robot into a screen element that can be manipulated from the keyboard to create any number of shapes on the display.

The turtle removes some of the onus from many educational ventures—learning geometry, for instance. Rather than mastering an abstract coordinate system, kids simply tell the turtle to move one way, then the other, to draw standard geometrical shapes. In turtle geometry, they need only imagine how the turtle has to move and then convert their insights into Logo instructions. To draw a square, for example, a child first pictures walking in a square: One moves forward some distance, turns at a right angle, and repeats this action a total of four times. The Logo procedure for creating a square 50 units on a side is simply

```
FORWARD 50 RIGHT 90
FORWARD 50 RIGHT 90
FORWARD 50 RIGHT 90
FORWARD 50 RIGHT 90
```

or alternately

```
REPEAT 4 [FORWARD 50 RIGHT
90]
```

Compare this with explaining how to draw a square in any other general-purpose computer language, and you will begin to appreciate Logo's simplicity. Furthermore, this procedure can be used to create a square starting from any position. There is no need to modify it, as would be the case if one were working within a coordinate system.

Teaching geometry to children is only one of the turtle's many uses. It also can assist in exploring advanced mathematical concepts in topology, vector analysis, and curvature, as explained in a college-level text, *Turtle Geometry,* by Harold Abel-

Logo's charm is that the user can determine the work's scope, direction, and sophistication.

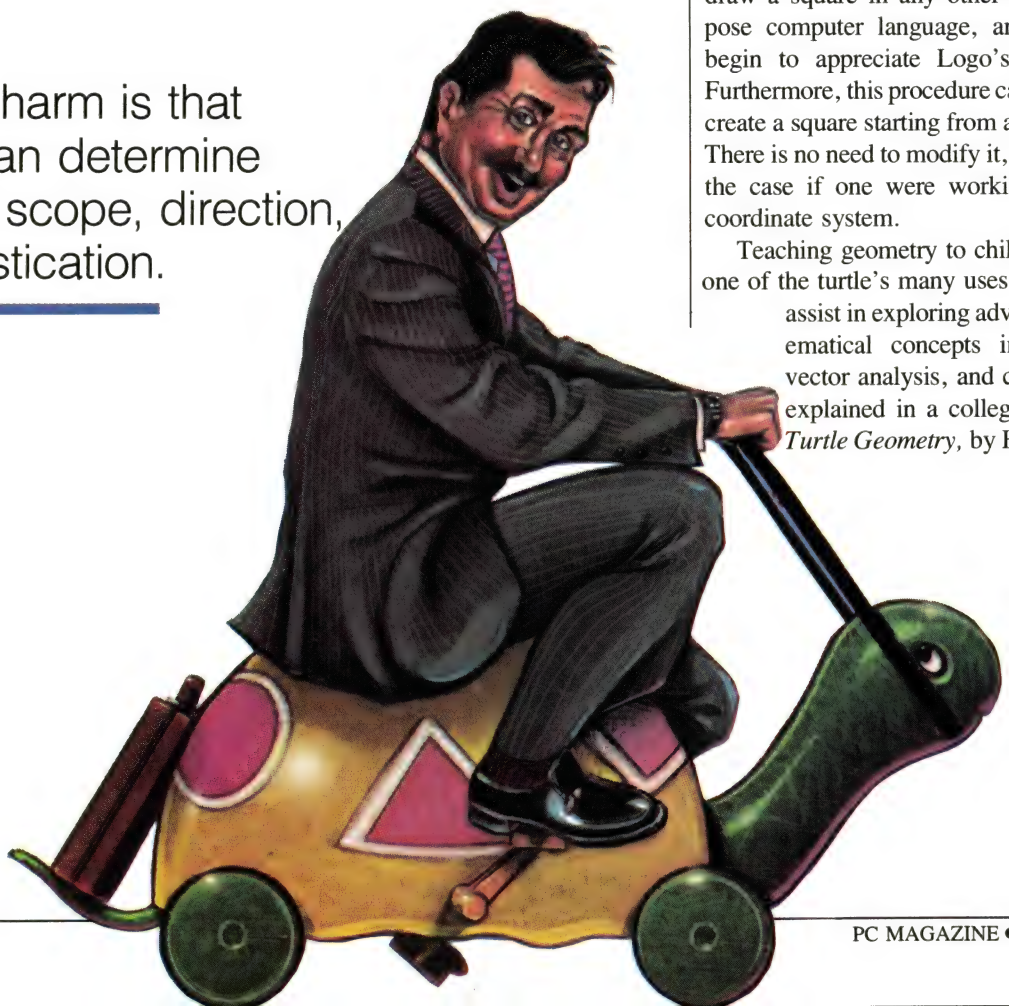


Illustration: Earl Keleny

son and Andrea diSessa (MIT Press, 1981). Turtles are definitely for grown-ups, too.

### Logo: More than a Turtle

Other Logo features are also ideally suited for adult uses, in large part because Logo is a mature language that offers many techniques that are only marginally available in other languages such as BASIC, COBOL, FORTRAN, and PL/1. Logo supports GOTO-less programs, procedures with single outputs, descriptive variables, interactive debugging facilities, top-down programming, and prototyping.

Because Logo is descended from LISP, a *list*-processing language widely used in AI research, it handles complex lists of information with exceptional ease. As a consequence, Logo programs manage text in surprisingly simple ways—for the benefit of children and adults alike.

One example of Logo's list-processing techniques is the generation of nonsense sentences. In order to develop such a program, 3 lists are first created; one for subjects, another for verbs, and a third for objects.

```
MAKE "SUBJECTS [MARY TOM JANE
SAM SALLY HARRY]
MAKE "VERBS [BUYS SELLS
BREAKS FIXES LIFTS DROPS]
MAKE "OBJECTS [TOYS HOUSES
CATS DOGS PENCILS COMPUTERS]
```

These commands will create three lists, each of which contains six members. These lists will then be referred to as :SUBJECTS, :VERBS, AND :OBJECTS when used in Logo. We now create a procedure to pick one member out of a list.

```
TO PICK :LISTOFMEMBERS
OUTPUT ITEM (1 + RANDOM 6)
:LISTOFMEMBERS
END
```

The PICK procedure takes one input, which we have called :LISTOFMEMBERS. The procedure RANDOM 6 will output a random integer less than 6. The expression (1 + RANDOM 6) will then result in a number from 1 to 6. ITEM is a built-in Logo procedure that takes two inputs. The first input is the number of the item we wish to pick out of the second input. The first input to ITEM is our random number and the second input is our list. The result will be that the procedure PICK will output a random item from a list. We now want to pick three random words from our lists and combine them to make a sentence. The Logo procedure SENTENCE combines two items and makes them into a list. Let's first pick our subject

```
PICK :SUBJECTS
```

and let's combine this statement with our verb.

```
SENTENCE (PICK :SUBJECTS)
(PICK :VERBS)
```

Now we can combine the result with our object

```
SENTENCE (SENTENCE (PICK
:SUBJECTS) (PICK :VERBS))
(PICK :OBJECTS)
```

The parentheses are included for clarity but are not needed. Abbreviating the word SENTENCE to SE, we can then put a PRINT command in front and end up with:

```
PRINT SE SE PICK :SUBJECTS
PICK :VERBS PICK :OBJECTS
```

The result is a routine that will generate our nonsense sentence. We can make this a procedure called NONSENSE.

```
TO NONSENSE
PRINT SE SE PICK :SUBJECTS
PICK :VERBS PICK :OBJECTS
END
```

This procedure will generate one silly sentence.

```
TOM DROPS DOGS
```

One of the outstanding features of Logo is its ability to handle recursion, a procedure's ability to call itself. We can modify our NONSENSE procedure to be recursive, thus:

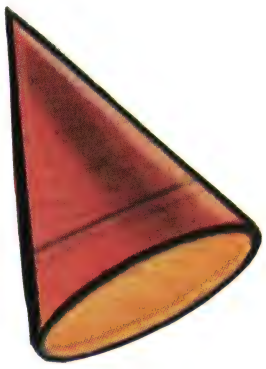
```
TO NONSENSE
PRINT SE SE PICK :SUBJECTS
PICK :VERBS PICK :OBJECTS
NONSENSE
END
```

As a recursive procedure it will generate nonsense sentences forever.

```
TOM BREAKS PENCILS
SALLY SELLS TOYS
SAM BUYS COMPUTERS
HARRY DROPS HOUSES
JANE FIXES DOGS
SALLY LIFTS COMPUTERS
:
:
:
:
```

Despite the playful nature of these examples, recursion and list-processing are not children's toys. Logo is a powerful interpreted language, and the newer PC versions of Logo have opened it up to broad, general use.

The articles that follow will survey the current implementations of the language, including Dr. Logo, IBM Logo, and PC Logo. ■



## Logo descends from LISP, a language used in AI research and designed to handle list-processing.

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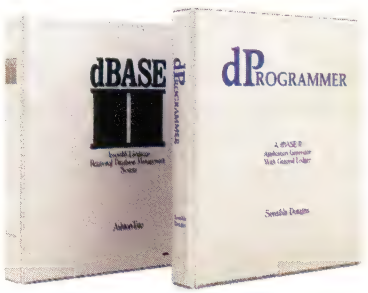
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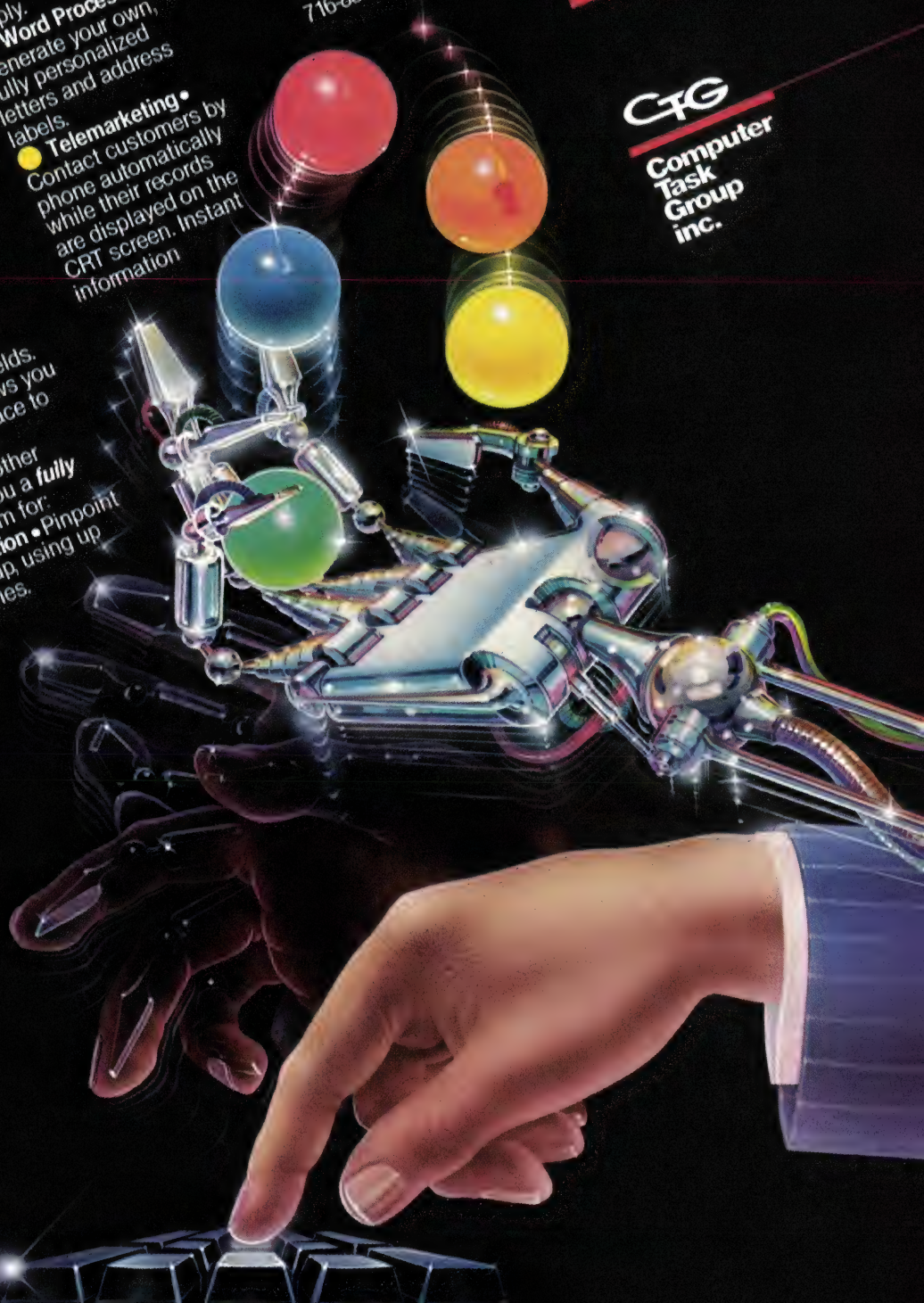
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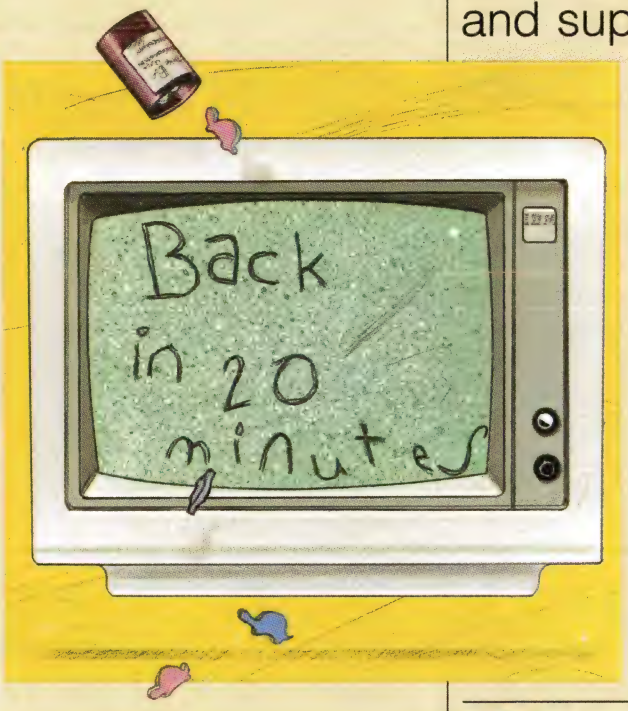
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# The Doctor is Indisposed

Dr. Logo's advanced features, including excellent debugging facilities and superb turtle graphics, can cure many programmer's ills. But Dr. Logo has some ills of its own.




SPECIAL REPORT
JANE & HAL LAMSTER

Dr. Logo, originally known as DR Logo, does not offer the best medicine for PC programmers (see "DR LOGO: A New Start for Beginners," *PC*, Volume 1 Number 11). Developed for the IBM PC by Digital Research, Dr. Logo compares favorably with other implementations of the language currently available on smaller machines such as the Apple II, the Commodore 64, the TRS-80, and the TI99/4a. But it fails to take full advantage of the greater power of the IBM PC. Its black bag lacks some of the "wonder drugs" or advanced capabilities of its competitor, IBM Logo.

This is not to say that Dr. Logo is a

Illustration: Earl Keleny

programmer's witch doctor. With its superb turtle graphics, excellent procedure editor, and few, if any, intimidating features, Dr. Logo is like a friendly general practitioner.

This GP wants you to manage the health of your own programs, so it provides tutorial and reference manuals that enable even a novice user to begin creating programs almost immediately. The tutorial manual, *Meet Dr. Logo,* leads beginners through the language step by step, commencing with the most elementary instructions. Along the way, it highlights significant items with "Trailmarkers" that contain reminders and explanations. Especially helpful are the sample programs printed in two colors—green for what the user types and black for the computer's response. An explanation accompanies each entry.

The reference documentation is marred by inadequate editing. The index is incomplete, and—a more serious failing—there are errors in some of the examples, such as those for the TONES command. The errata sheet misses many of the errors in the reference manual. However, Dr. Logo does include a fine glossary of general computer terminology and a separate command summary.

## Measuring up to the Family Name

The version of Logo developed by Seymour Papert at MIT for the Apple II is considered by many to be the standard against which other implementations can be measured, and Dr. Logo measures up reasonably well. It contains nearly all the features of the original MIT implementation.

Dr. Logo's advanced features include good error handling, a help command, redefined primitives, packaging and burying procedures, property lists, extensive computational and arithmetic functions, upper- and lower-case characters, improved screen resolution, comprehensive workspace management tools, and convenient debugging and tracing commands.

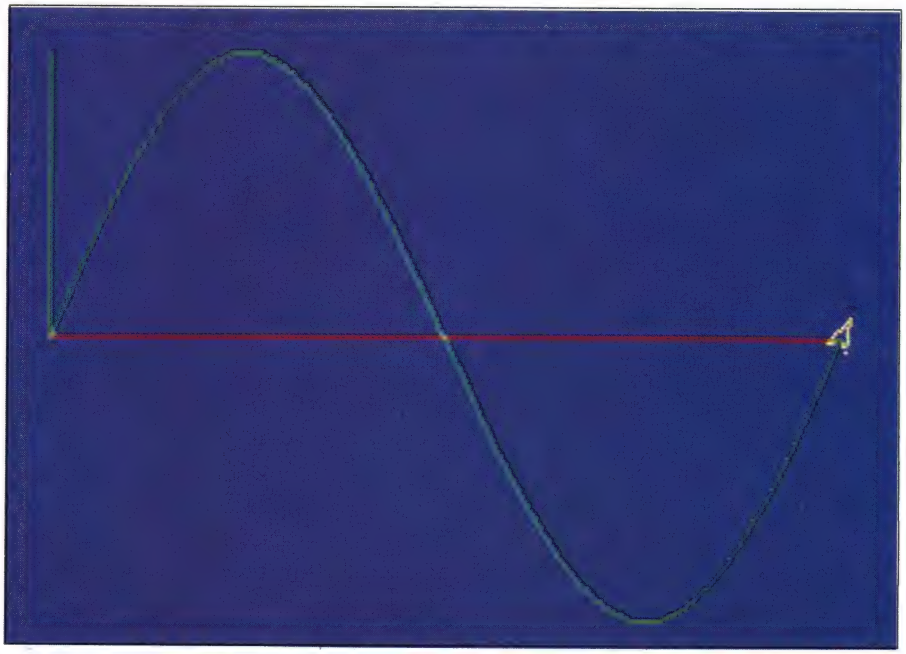
The PRINTSCREEN command dumps the graphics on the screen to an IBM Graphics Printer, while COPYON and COPYOFF send text to the printer. The

**Dr. Logo**
Digital Research, Inc.
P.O. Box 579
160 Central Ave.
Pacific Grove, CA 93950
(408) 649–5500
**List Price:** $99.95
**Requires:** 192K RAM, one disk drive, color/graphics display adapter and monitor.

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**A dandelion created with the PEN, SETPEN, and SETPOS primitives.**



**A sine curve created with turtle graphics.**

extensive arithmetic capabilities include trigonometric and logarithmic functions and support for decimal numbers with up to 15 significant digits. Floating-point numbers are internally stored in a standard 64-bit format with a range from $10^{-308}$ to $10^{+308}$. Those who are mathematically inclined will appreciate the use of +INF or −INF to represent positive or negative infinity. Artists will enjoy Dr. Logo's 16 background colors and two sets of three-color palettes for pen tracing.

One of Logo's exceptional features is that it permits you to extend the language with your own commands. You can package and hide procedures, which then behave like built-in functions or primitives.

If something goes awry with your programming, Dr. Logo's debugging facilities are the perfect remedy, especially the TRACE and DEBUG commands, which allow you to monitor the actions of a particular program as each of its commands is executed. The workspace management commands are extensive. Suppose you wish to gauge the impact of a change in a given procedure. Dr. Logo offers the command POREF, which prints out the names of all the procedures that call the one you changed. The FOLLOW command permits you to rearrange the order of procedures in your workspace, and the POPRIM command displays all or selected definitions of Dr. Logo primitives. This help feature is handy if you have misplaced the command summary booklet that comes with the documentation.

## What Dr. Logo Lacks

An important capability missing from Dr. Logo is a command to change the aspect ratio of the display. On our monitor (a Princeton Graphics HX12), the relationship between the height and width of the screen causes circles to appear oval. Dr. Logo offers no easy way to correct this.

The maximum number of nodes available in Dr. Logo is about 10,000, or about 50,000 bytes of workspace. Though significantly greater than the number of nodes available on some earlier versions, it is only about a third of the node space available with IBM Logo. Dr. Logo's implementation of the stack is also inferior to IBM Logo's. The stack, used by the interpreter to keep track of which program is currently running, can easily be overrun, which affects the number of times a recursive procedure can be called. A simple recursive countdown procedure could manage 514 recursions using Dr. Logo. But IBM Logo can run hundreds of thousands of recursions without problem, probably because of the sophistication of its interpreter. It is apparent that the Dr. Logo interpreter is not nearly as sophisticated in handling recursion as interpreters found in other Logo implementations.



For artists, Dr. Logo provides 16 background colors and two sets of 3-color palettes for tracing.

## What You Need

Dr. Logo requires the IBM Color/Graphics Adaptor, a color monitor, and a minimum of 192K RAM. It operates on a dual display system, with a monochrome monitor connected to a monochrome display and a printer adapter to display text and a color monitor to display graphics. On the Compaq, with its built-in display, the graphics are in various shades of green. Dr. Logo will not operate with a monochrome display only nor with a black and white monitor connected to the color adapter.

Dr. Logo runs under the CP/M-86 operating system, not under PC-DOS. It self-boots from the limited copy of CP/M-86 included on the program disk, so you don't need to purchase the full CP/M-86 operating system (see "PC News," *PC*, Volume 3 Number 5). The 192K requirement means that Dr. Logo will not operate on the PC*jr*. Digital Research, however, is planning to overcome this limitation by releasing a version that runs with 128K RAM.

## Just What the Dr. Ordered?

We have mixed feelings about Dr. Logo. It appears to be a good general-purpose language, but the appearance is deceiving. Dr. Logo has the look of a language written by and for experienced programmers; it offers the immediate use of an 80-character screen for text, standard use of lower-case characters, the ability to direct output simultaneously to the screen and a printer, and, most significant, extensive debugging facilities. Nearly all of these features are missing from other versions of Logo. On the other hand, Dr. Logo is missing features that are fundamental to serious programming. The most critical omissions are a way to read and write data files and a facility for interacting with the operating system or interfacing machine-language routines. These limitations diminish the value of Dr. Logo as a general-purpose language.

We got the impression that Dr. Logo was rushed to market before it was finished. The general approach of the implementation is excellent and would certainly make Dr. Logo the choice of many serious users if it had the necessary functionality. We hope that Digital Research will apply strong medicine to its product. ■

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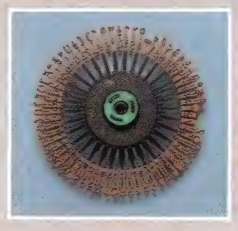
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SPECIAL REPORT

WINN L. ROSCH

# A Tale of

The flourishing Logo market is not the only focus of the IBM Logo and PC Logo competition. The main goal is to capture the position of the premier computer language.




Is it the best of Logo? Is it the worst of Logo? At first glance, the contest between PC Logo from Harvard Associates and IBM Logo seems no more than a battle between two turtles.

Logo, however, is more than mere turtle tracks. It is a newcomer to the IBM Personal Computer; no IBM-compatible version of the language is even a year old. This language was designed in the early seventies primarily as a classroom tool, but the warring in the weeds documented here is only an elimination round. The winner is destined to carry the Logo banner into what may be the biggest battle of all, Logo versus BASIC as the premier personal computer language (see the accompanying sidebar, "BASIC Survival and the Logo Challenge"). Judging from the initial skirmishing, the victory may be an unprecedented upset.




# Two Logos

## A Look at the Books

The first look you get at any program is the book that tells you all the wonderful things you can do and how to do them. Both PC Logo and IBM Logo come with exemplary manuals. The IBM version comes in a standard IBM binder in a yellow bright enough to make sunglasses a useful option. PC Logo is bound in a slightly larger, gray vinyl, looseleaf book. Although the contents of each manual are, by necessity, similar, the two differ tremendously in style and arrangement. There's no clear winner; each compendium has its strengths.

If you've never encountered a turtle before, PC Logo should be your first choice. More than half of its manual is a turtle tutorial that effectively introduces Logo's syntax. Although it is written at a level appropriate for school children up to about ninth grade, no adult should be put off by it.

The PC Logo tutorial is hardly faultless, however. Perhaps the most objectionable part is—would you believe—the typesetting! And I'm not picking nits—the type-them-in-yourself program listings are shown in boldface, presumably to distinguish them from the rest of the text. But the boldfaced typesetting resembles Presstype (or other dry transfer lettering) applied by someone with the shakes. Its coarseness makes discerning spaces between words a job for eagles, not human beings. In any other language such a problem would be a small point, but in Logo spaces are extremely important. The IBM Logo manual does not advance the art of typography, but it does make spaces between words unambiguous.

The IBM manual's tutorial on the lan-

**PC Logo Version 2.0**
Harvard Associates, Inc.
260 Beacon St.
Somerville, MA 02143
(617) 492-0660
**List Price:** $149.95
**Requires:** 64K RAM, one disk drive; color/graphics card optional.

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IBM Corporation
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P.O. Box 1328
Boca Raton, FL 33432
(800) 447-4700
**List Price:** $175
**Requires:** 128K RAM, one disk drive; color/graphics card optional.

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Illustration by Earl Keleny

guage's features is useful, but brief compared to the PC Logo lessons. To help younger learners, IBM includes a spiral-bound booklet, *Logo: Programming with Turtle Graphics*. The book is exactly what it's name implies, a tutorial on turtle graphics. It does an excellent job of covering drawing, file usage, and screen modes, but, unfortunately, it does not begin to tap the full power of Logo in list processing (text) or mathematics.

strength of the manual alone. I tested both implementations hands-on. IBM Logo and PC Logo (version 2.0) will run on any IBM Personal Computer, including the PC*jr*. IBM's implementation requires 128K of random-access memory; PC Logo requires half as much. Both benefit from extra memory—IBM Logo can make use of up to 256K bytes of RAM; its competitor can use 192K bytes. Both Logos come on disk, and neither is copy

allows any number of columns of characters less than or equal to 80. If more than 40 characters per line are desired, the skinny 80-column character set is used for displays; the wider character set is reserved for displays 40 columns wide or less.

### Doing the (Screen) Splits

An interesting difference between the two dialects is the way they handle split-screen displays in which the bulk of the



Screen mode and formatting are areas of real difference between the products of IBM and Harvard Associates. PC Logo has seven different screen modes; IBM Logo has one graphics mode.

Where the IBM Logo documentation shines is in its reference section. In style it's similar to the IBM BASIC manual, featuring both an in-depth explanation of primitives (commands) and a profusion of examples for every occasion. The bulk of it is arranged by the name of the primitive, and it's quick and easy to use.

PC Logo prefers to arrange its reference section on primitives by function. To zero in on a specific primitive, you must first visit the index, then go hunting through its references—likely several of them—before you find what you want. For casual reading to get an overview of what makes Logo work, the PC Logo manual makes sense, but for quick checks while programming, the IBM manual is easier and faster to use.

### Logo versus Logo

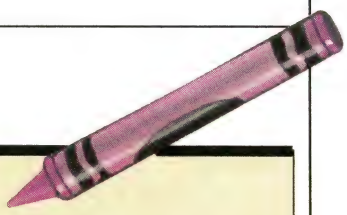
No language gains preeminence on the

protected. An extra utilities disk supplied with PC Logo carries demonstration programs that can be studied to learn about the language. IBM Logo, on the other hand, includes on its single disk a file of "tools," which are actually more like utilities—short programs to add features not built into the language itself.

Screen mode and formatting are areas of measurable difference between the products of IBM and Harvard Associates. PC Logo has seven different screen modes matched to the IBM PC's capabilities—40-column text in color and monochrome, 80-column text in color and monochrome, 320 by 200 graphics in color and monochrome, and 640 by 200 high-resolution black and white graphics. IBM Logo has a single graphics mode: 320 by 200 line, medium resolution, in 4 pen (drawing) colors with the full IBM 16-color range for background. Textscreen in IBM Logo

screen is devoted to turtle graphics and only the lower left given over to text. In IBM Logo, the whole screen remains an active area for the turtle—it can actually draw over text. Pressing one button or typing "full-screen" blasts away all the text and leaves the turtle and its drawings unscathed, alone on the screen.

PC Logo's text is not willing to share the screen. In split-screen mode, the lower portion of the display is off limits to the turtle. Furthermore, if you shift from full-screen graphics to split-screen mode, the graphics from the lower part of the screen are irrevocably erased—when you flip back to full-screen mode (by pressing a function key), the bottom of the screen becomes empty and available for drawing again. I also discovered that flipping between display modes makes the turtle lose its place—the turtle becomes rabbit-like and hops all over the place, and the



# BASIC Survival and the Logo Challenge

Logo has the potential to displace BASIC from its niche as the dominant micro computer language. In the emerging competition, only the fittest will survive.

BASIC's dominance of the field of microcomputing is less secure now than at any time in its 20-year history, and the reason is the appearance of several highly successful implementations of Logo for the IBM PC. The mature state of microcomputing and the intrinsic advantages of the Logo language will very possibly combine to diminish permanently BASIC's preeminent position. A look at Logo's past explains why.

Whatever their differences, most Logo dialects boast of the same roots in MIT's artificial-intelligence laboratory, where the original Logo language was developed by Seymour Papert as part of a project to turn the personal computer into a revolutionary educational tool. A central concept and first step in Papert's work was the turtle microworld—what we call "turtle graphics"—which allow children to learn advanced geometric concepts by exploring and interacting with their ideas as never before possible—on a computer display.

In Logo's infant years, turtle graphics proved so captivating that educators and programmers alike failed to explore the rest of Papert's ideas. But Papert's project has a scale that reaches far beyond the turtle; it involves an almost unlimited number of educational microworlds. Logo's real place in Papert's work is to make designing and working in these new microworlds easy.

A microworld is nothing more than elaborate software, just as all other computer programs are software. If Logo makes microworlds easy to manage, it should do the same for everyday programming, and in fact, it does. Because both PC Logo and IBM Logo embody Papert's underlying philosophy, they reach beyond turtle graphics to become true general-purpose computer languages as capable as either BASIC or Pascal (or nearly any other language).

Logo's greatest strength is its ease of learning, which makes it the language of choice for new computer owners. Alas, Logo's ease of learning has given the language an image problem, attributable in part to the popular belief that the more powerful a programming language is, the more difficult it must be to learn and use. Following this specious notion, programmers assume that because Logo is so much fun, it cannot be considered seriously as a programming language.

Logo's programming abilities have not been compromised by its simplicity of learning or use. The reason has to do with the way the language was conceived. From the perspective of user convenience, most computer languages were created backwards—the designers began with an analysis of the problems to be solved and sought the easiest way to solve them. The designers of Logo, however, first considered how human beings work through their tasks and then created the easiest means possible for them to do so.

## Logo versus BASIC

The original philosophy behind BASIC was far from the Logo ideal. BASIC squeezes as much power as possible into as little memory as possible. Such a goal is understandable—when BASIC was originally written, computer memory was expensive.

The need to conform BASIC to the limited hardware of the time had unfortunate results. Pioneering hobbyists had to put up with the unintelligible and unyielding demands of a rudimentary language to get their microcomputers to do anything at all. When the first generation of personal-computer engineers who grew up with primitive hobby machines and the quirks and demands of BASIC decided to add more power to their computers, it was only natural for them to add more functions to their familiar, if antiquated, language rather than alter its structure—despite the fact that structural changes would have made computing more tractable.

In contrast to BASIC, Logo began life with the optimistic thought that computers will continue to become increasingly powerful and that their increased power could be tapped to make programming languages easier to use and understand—so easy, in fact, that turtle graphics can be used by preschool children.

Papert did not design Logo with the constraints of a tiny microprocessor in mind. He believed that a good computer language for children must be a good computer language—period. He based Logo on another language called LISP, used primarily in artificial-intelligence research on mainframe computers. Logo simplifies LISP's syntax without compromising its power.

A battle between Logo and BASIC may be shaping up, and IBM PCs may just fire the first shots. Papert believes that IBM machines are the first computers powerful enough to combine ease of use and sufficient computing power to take Logo out of the schoolroom and put it to work in the business world. The power-packed pair, PC Logo and IBM Logo, will be instrumental in establishing the language in the real world of serious programming. **—W.L.R.**

resulting graphics can take strange turns.

In BASIC, you can make your writing more colorful—literally—by changing the color of the monitor's display in text mode. PC Logo, however, doesn't even make a pretext of offering such color antics. You can have your text any shade you want, as long as it's white on black. (You can try using the SETBG—or SETBACKGROUND—primitive, which changes the hue of both background and border in graphics mode, but it will put only a colorful border around your screens of text. You will see white letters over your chosen color background only when you split the screen between graphics and text.)

Your artistic nature will not find complete satisfaction with IBM Logo either. With its SETTC (for set text color) command, you can set both a foreground (character) and background color in text mode. But the border remains obstinately black no matter what you try to do. The SETBG command changes both background and border to the same color in graphics mode. These minor but bothersome omissions may be the subject of future revisions.

### Mathegraphics

The two Logos obviously handle their mathematics functions differently. PC Logo boasts that it can take advantage of the legendary 8087 math coprocessor chip to increase calculating speed up to 50 times. Not having an 8087, I can't vouch for the truth of this claim. But I can assert that as far as math is concerned, PC Logo belongs in the slow track. You get two decimal places and a grand total of six digits of precision. That means, of course, that 1/9 equals exactly 0.11 and 1/7 equals exactly 0.14. PC Logo can tackle scientific notation, but again you face the six digit, two decimal place limit.

Math is one area where IBM Logo takes the language a giant step beyond BASIC. Far from being limited to just single- or double-precision arithmetic, IBM Logo is capable of almost infinite precision—up to 1,000 significant digits for most operations. Ask for 1/9 after you "SETPRECISION 1000" and after a couple of seconds, your screen will fill up with 1s. Ask for the square root of 3 with that precision setting, and you could almost take a short vacation (eventually, in, say, about 10 minutes, the answer appears).

The difference in handling numbers pops up prominently in, of all things, turtle graphics. The IBM version of the language appears to be better wedded to the machine, since PC Logo's rounding errors result in some imprecise drawings. The problem became apparent with a simple test program I wrote—the turtle draws a hexagon, turns 10 degrees, then draws another, ad infinitum. In theory, after the 36th repetition, the turtle should begin tracing over tracks it has already drawn—at least that's what happens with IBM Logo. But the PC Logo turtle missed its tracks by a slight fraction and kept going around. As the turtle tried to retrace its steps, the lines of the figure became broader and broader until the sharp weblike pattern had turned into a shapeless blob on the screen.

Another difference that may be related to the 8087 coprocessor is the speed at which the turtle races through its drawings. In theory, the 8087 should make PC Logo's graphics faster than IBM's. Without the coprocessor, however, the PC Logo turtle loses the race.

## A Word from the Founder

### The originator of Logo is impressed by IBM Logo's strong family resemblance to other commercial versions of the language.

Not to discredit the worth of my own Logo evaluation, I did seek out a higher authority for his views. The authority most qualified to evaluate Logo is Seymour Papert, who created the language and formulated the educational philosophy it supports. While interviewing Dr. Papert for *PC*'s sister publication, *PCjr. Magazine,* I popped the question: "Which dialect of Logo is best?"

At first he was reluctant to say. Each has its place, he believes, and together all versions of Logo will help bring a new computer literacy and even greater understanding and knowledge to the world.

He did recognize the unique advantage of one version: IBM Logo. Surprisingly, the edge he sees for IBM Logo is not its official moniker or Big Blue backer. What impresses Papert is that its creator, Logo Computer Systems, Inc., or LCSI, also authored Apple Logo, Texas Instruments' Logo, SmartLogo for the Coleco Adam, Atari Logo, Logo for the DEC Professional 350, and (soon-to-be-available) Macintosh Logo. IBM Logo's strong family resemblance with all these other Logos makes it (and its siblings) the closest thing available to a universal version of the language.

Harvard Associates believes its language plays the same role in relation to official IBM Logo as Terrapin Logo plays to the official Apple version of the language—as a more workable classroom alternative. The relationship is natural for the firm to assume, since many of their members once worked for Terrapin and formed their own company when they realized that the need for a Logo for IBM computers was not being met by Terrapin. But the use of PC Logo will have to spread far beyond the classroom for it to challenge the LCSI family of Logos' headstart on creating a Logo lingua franca.—**W.L.R.**

## Friendly Prompts

One of Logo's greatest strengths can be described by that oft-misapplied phrase, "user friendliness." The language *is* easy to use. And it can be genuinely friendly. IBM Logo even answers you in the first person when it has a problem. If you ask IBM Logo to do something outside of its vocabulary, it answers politely, "I Don't Know How To Scrooch" or whatever you've asked it to do. If you get frustrated and type in an obscenity, you may be delighted with the response. PC Logo, on the other hand, avoids unseemly familiarity, maintaining a staunchly machine-like manner. "Scrooch Is Not a Logo Procedure", it will inform you.

Like BASIC, Logo wants a print command before it will output results to the screen. But at least it doesn't consign your answer to oblivion if you forget to preface your questions properly. If you forget the PRINT or PR in PC Logo, the program will answer, "Result:". IBM Logo is both friendlier and more confusing, it answers: "I Don't Know What to Do With . . ."

PC Logo is not sensitive to upper- and lower-case letters. The commands FORWARD, forward, and even ForWArD are all equally intelligible. When you start, the program initially defaults to all caps when you type alphabetic keys. Pressing the Shift key brings up lower-case, and pressing Caps Lock reverses the default and permits you to set things typewriterlike.

IBM Logo cares about case. Type in "fd" instead of "FD" and Logo will answer "I DON'T KNOW HOW TO fd." At turn on, the program defaults to all caps and only lets you type lower-case while you hold down the Shift key (Caps Lock does absolutely nothing). Although this arrangement helps protect you from making a mistake in case, it also makes typing screens of text inconvenient.

## Files, Ports, and Packages

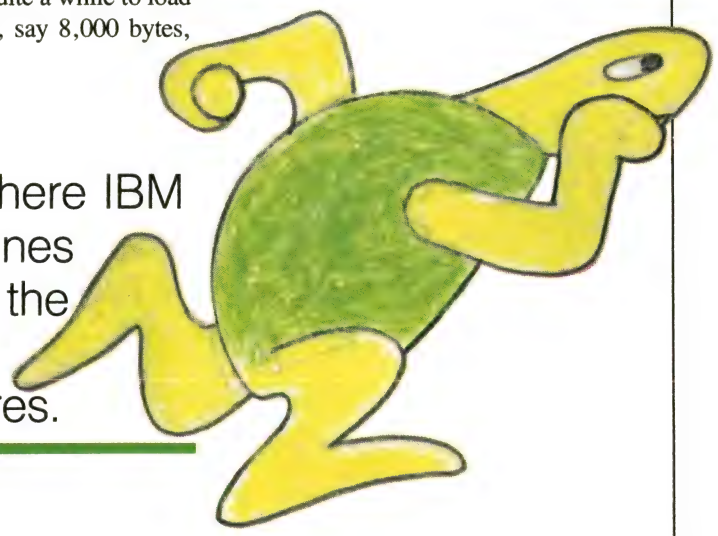
PC Logo seems to have an edge when it comes to reading disks. You can tell the program to load a file, and in seconds, your program is read from the disk, loaded into memory and ready to go. Every time PC Logo finds a procedure in a disk file, it assures you that it has been read into memory by echoing to the screen that the procedure has been defined. IBM Logo spends a much longer period alternately spinning the drive, turning it off, and spinning it again. It takes quite a while to load a moderately long file, say 8,000 bytes, but the program does nothing to assure you that all is well. The only sign that the program has finally loaded and that the disk drive didn't just finally die is the return of the question mark (?) prompt to the screen.

PC Logo is in some ways an assembly language programmer's dream. You can get at every byte in memory and every port in the machine with simple instructions. IBM Logo has fewer assembly language primitives, but includes .DEPOSIT and .EXAMINE (roughly equivalent to BASIC's POKE and PEEK).

Both Logos have good editors. PC Logo has an especially welcome search and replace function, which can race through multiple procedures and change the name of a variable (or primitive) throughout a file with a minimum of keystrokes. But the PC Logo editor does have one unnerving function (one you'll probably get used to)—it redefines the Del key to mean "remove everything on the line to the right of the cursor." If you forget that for a moment, you may find yourself retyping your work.

An area where IBM Logo shines and PC Logo barely flickers is the packaging of procedures. A package lets you link several procedures together so that they can be loaded and saved to disk merely by using a single package name. It's a convenient feature when your program has two or three dozen procedures in it, which is not uncommon in Logoland. PC Logo lets you add procedures to files and save the entire workspace but does not otherwise package procedures together.

An area where IBM Logo outshines PC Logo is the packaging of procedures.



IBM Logo also handles property lists, which let you assign a quality or property to individual elements of a list. (Lists are to Logo as arrays are to BASIC, but, because they do not have to be dimensioned, lists are easier to use.) Among other functions, property lists can build writing programs that "learn" and simplify the creation of specialized databases.

Dribble files, another feature of IBM Logo not present in PC Logo, can aid in educational applications. A dribble file is a play-by-play record of every command that is given Logo, which a teacher can search through at his or her leisure to see what the child has been up to.

IBM Logo NODES command lets you see how much workspace (memory) you have left, whereas PC Logo keeps you in

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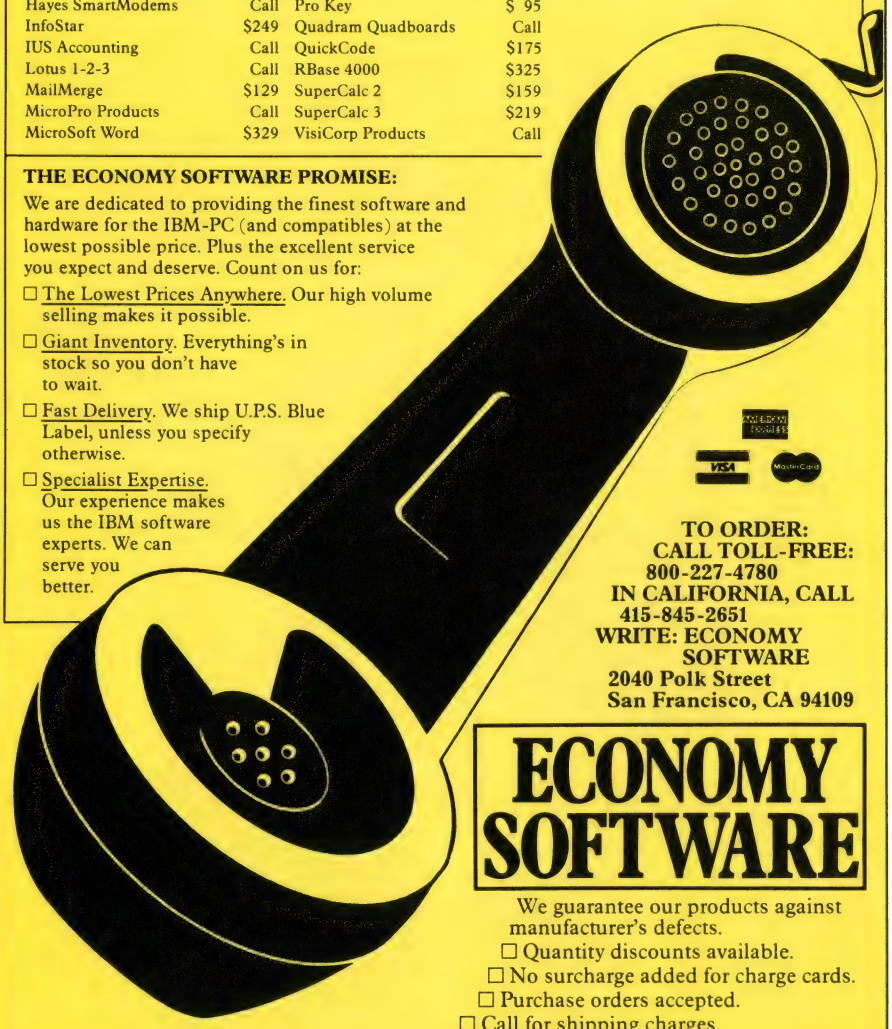
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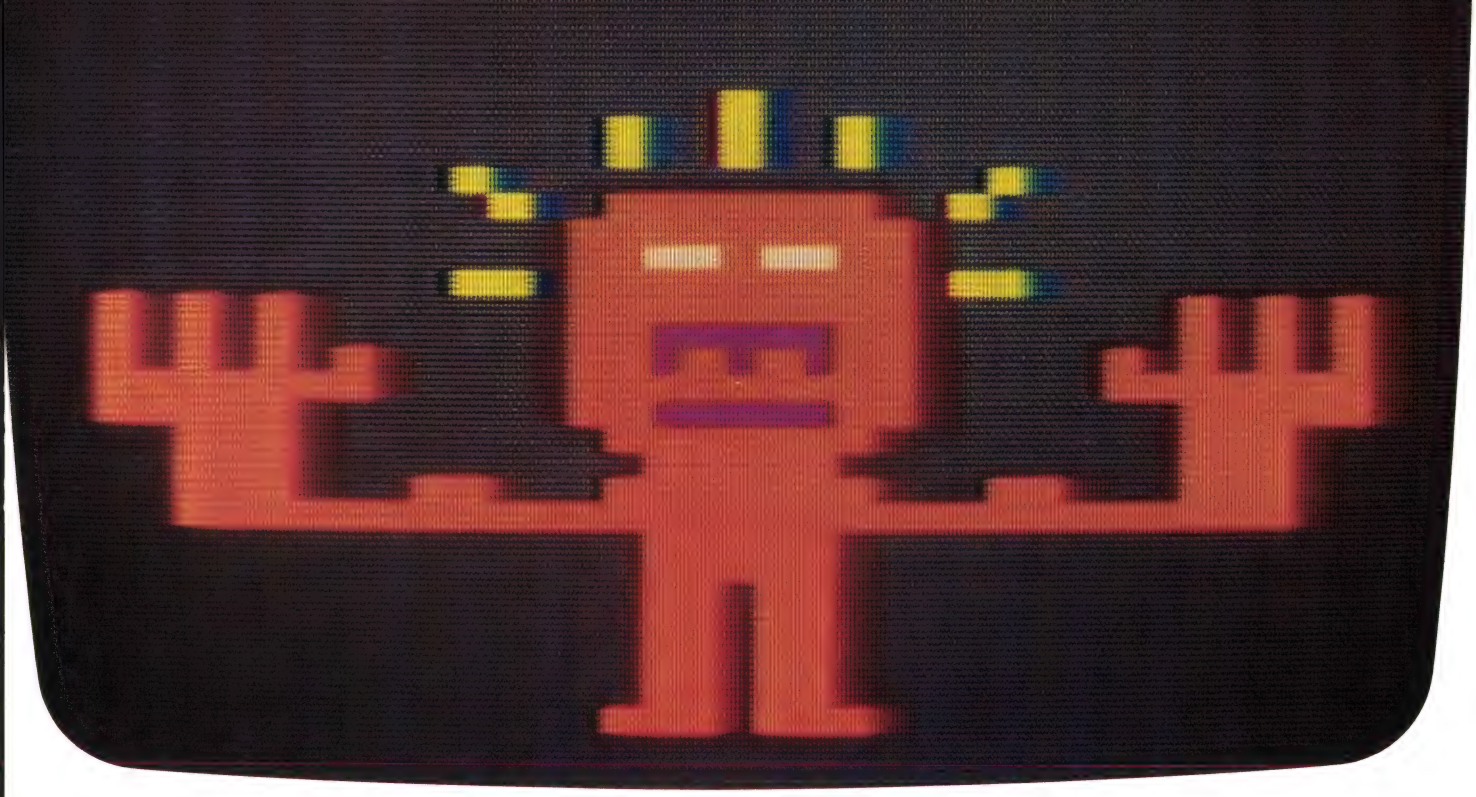
### Living with the Logos

In one respect, the gap between the Logo dialects is extremely wide. IBM Logo and PC Logo are incompatible. Only the very simplest programs written with one can run on the other. The irreconcilable difference is vocabulary. A few primitives (commands) have slightly different names in the different dialects. Some primitives are not shared, and a program will not run under a given Logo if it contains unfamiliar primitives.

Because the underlying structure of both dialects is so similar and files are reasonably close to standard ASCII, translating programs between the two dialects is not too difficult—although it can become tedious (PC Logo's editor with a search and replace operation can make the translation easier). Primitives that are different or nonexistent in the Logo you are translating a program to can simply be defined as procedures.

For the most part, turtle graphics primitives are exactly the same, so either dialect may work well with most introductory books about Logo, particularly those written for children. Both PC Logo and IBM Logo are suitable for classroom work—but Harvard Associates has given its language a unique advantage, a special low-cost multiple-user license for PC Logo in educational applications. By paying a modest fee an entire classroom can use and make copies of the program without copyright infringement. Harvard Associates will also sell its program's documentation separately.

Either Logo can handle difficult text manipulation, though IBM Logo's more precise mathematical and property list abilities make it the choice for scientific or business applications. Allowing for the admitted limitations of both Logo dialects, you'll probably find that you can do anything with either of these Logos that you can do in BASIC. I won't say better, because "better," like beauty, is in the eyes of the beholder. ■



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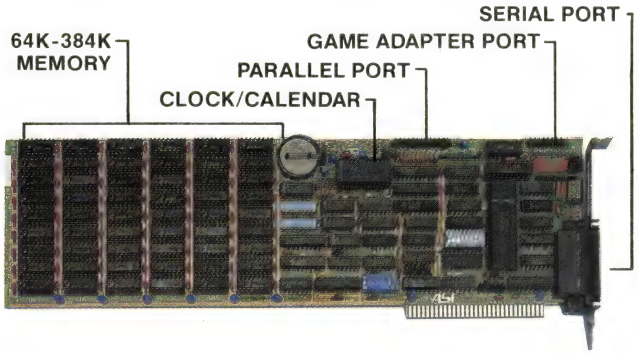

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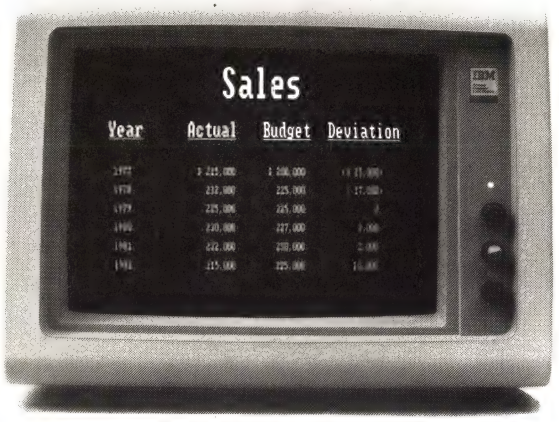
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- Save a screen in a lot less than 16K of disk space (PYXEL Visuals uses only 1-3K);
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PYXEL Visuals does all this and more. Because you need something more...a low price. For only $98 you can be producing presentations (and signs and report covers) NOW. Without wasting time to figure out how.

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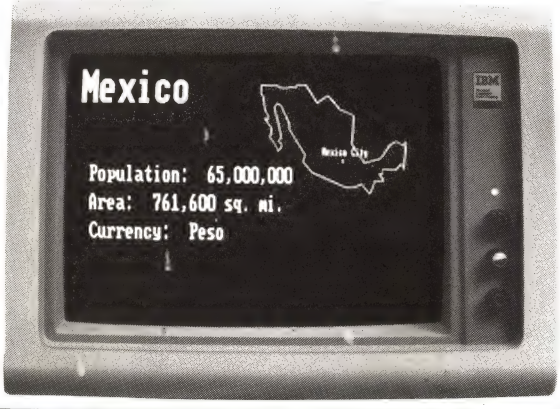

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Our support is as simple as our software. We value our customers. You can call and get help with a problem. You'll receive updates and enhancements without rebuying the package. And, as a registered customer, you'll be offered new products at reduced prices.

Actual IBM Graphics Printer Output

## BatchPrint

BATCHPRINT prints PYXEL Visuals screens in one of four proportionally spaced print modes: high resolution bold, high resolution light, low resolution bold, and low resolution light.




You choose the spacing between screens on the hard copy so you can print short pages and very long pages. Of course, with a name like BATCHPRINT, you can print up to 42 screens while you get a second cup of coffee.

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**Richmond, VA 23235**
**(804) 320-5573**

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Requires: IBM PC with PC-DOS; 128K RAM; Color/Graphics Adapter; Graphics Monitor; EPSON MX-100, MX-80 with GRAFTRAX, FX-80 or IBM Graphics Printer.
DOS 2.0 and XT compatible.

CIRCLE 223 ON READER SERVICE CARD

# A Logo with the IBM Label

Like fine clothing, IBM Logo has been tailored for many uses, from casual to formal. This well-crafted implementation belongs in the wardrobe of even the most fastidious programmers.

**SPECIAL REPORT**
JANE & HAL LAMSTER



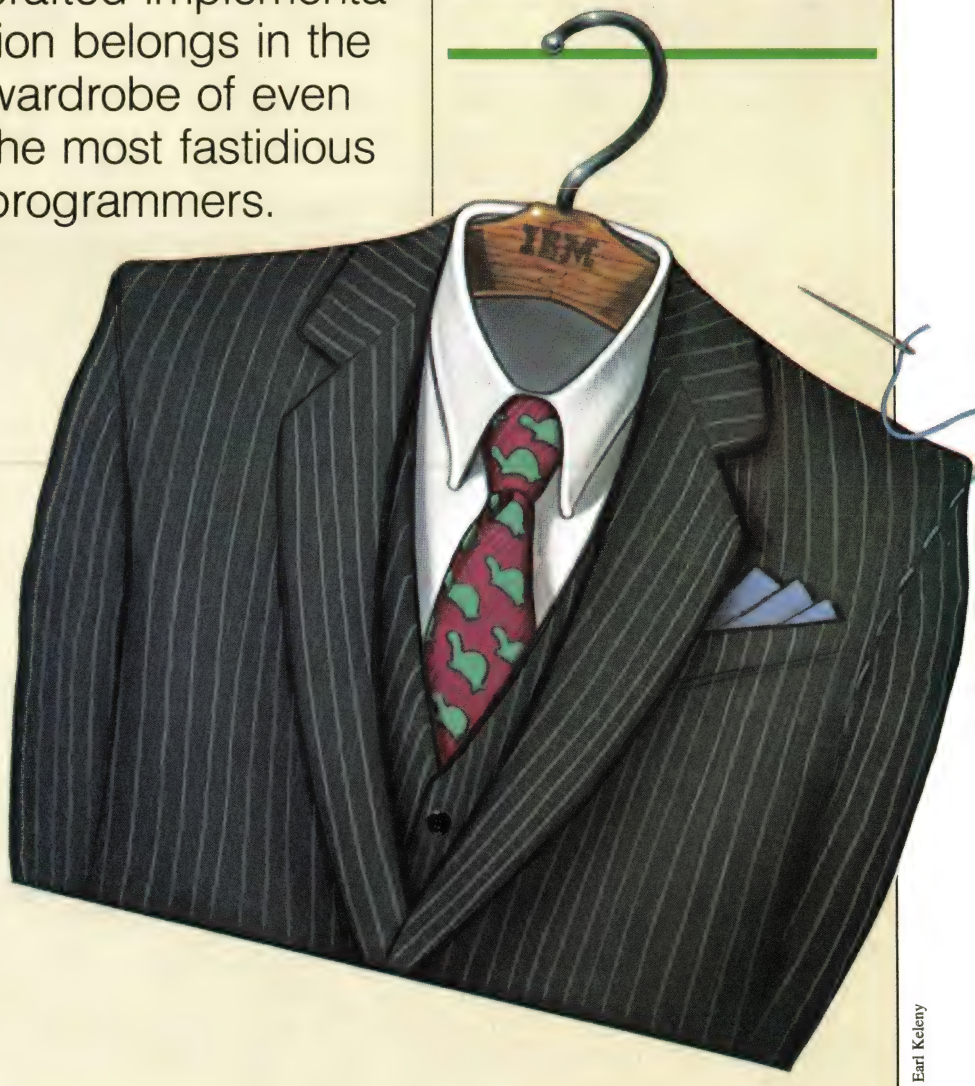



Illustration: Earl Keleny

If you want the equivalent of buying Brooks Brothers, you'll want IBM Logo. It costs a little more than the competition, but think of the label and the quality behind the name. IBM Logo offers all the features of the Logo developed at MIT by Seymour Papert, and then some. Because of the PC's substantial memory capacity, it can handle large and complex programs and offers features that were not available in earlier versions of the language.

## A Private Tutor

In good IBM fashion, the documentation is clear, easy to read, and well organized. First-time users will feel they are in the care of a first-rate tutor as they work through the tutorial, *Logo: Programming with Turtle Graphics*. Its numerous inserts, or "Bug Boxes," are indicative of the attention lavished on beginners; each describes a common problem that novices are likely to encounter, gives the possible reasons for it, and outlines the appropriate

corrective action.

For the more ambitious user, the reference manual contains a chapter entitled "Developing a Logo Project." The project in question is an interactive program of arithmetic "story" problems of the type: "Mimi had 10 cakes. She bought 5. How many did she have then?" The user types in the answer, and the program responds with an appropriate comment, such as "Right" or "Try again."

The chapter nicely illustrates Logo's approach to problem solving—breaking complex problems down into simpler elements and then reassembling the answers to the most fundamental questions into a solution to the whole. The first step, for instance, is to identify the project's three subgoals, such as creating a subprogram for generating the stories. Each subgoal is then itself analyzed in a similar way.

IBM Logo's fine documentation is complemented by the high quality of the language's implementation. The turtle graphics are superb. IBM Logo offers 16 background colors and has 2 palettes, each of which contains 3 colors for pen tracing. The graphics screen image can be dumped to an IBM Graphics Printer. In case the aspect ratio of your display causes screen images to distort, the .SETSCRUNCH command will make the proper adjustment to set things right.

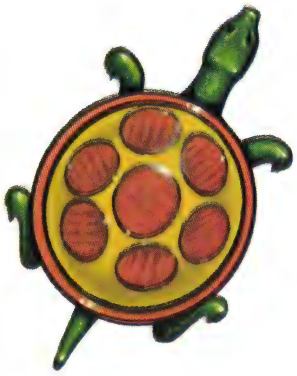
## Dribbling on Screen

Even novice users will be able to develop their own simple programs almost immediately. And if they make mistakes, IBM Logo's straightforward error messages will help put them back on target. If confusion occurs over a message such as "Can't Dribble on Screen" because a user doesn't remember how a language can dribble, let alone do so on screen, then the user can always look up the explanation in the reference manual. (For the meaning of *dribble,* see "A Tale of Two Logos" in this issue.)

Beginners with limited equipment will find that IBM Logo works with a black-and-white monitor or color TV using the IBM color monitor display adapter. But running the language on an IBM monochrome display flips the turtle on its back, so to speak, and eliminates turtle graphics. We were able to run IBM Logo on the Compaq and the Columbia Data Products MPC with a color adapter and color monitor. New and experienced users may want to take advantage of the possibility of using a dual monochrome and color setup.

**IBM Logo**
IBM Corporation
Systems Products Division
P.O. Box 1328
Boca Raton, FL 33432
(800) 447-4700
**List Price:** $175
**Requires:** 128K RAM, one disk drive, color/graphics card optional.

CIRCLE 707 ON READER SERVICE CARD



Programmers will be especially grateful for IBM Logo's mature file-handling capabilities.

## For Experienced Programmers

Does IBM Logo have anything to recommend it to experienced programmers? All programmers would love to be able to customize the language they are working with, and IBM Logo makes this possible with procedure packaging and burying commands. This capability is extended by extensive facilities for interacting with the entire system at the level of bytes of memory, including the so-called dot (.) commands that function like PEEK and POKE in BASIC. IBM Logo can actually load, save, and call assembly language routines. The reference manual provides detailed information on the underlying system, including memory maps, for the benefit of the experienced user.

Other advanced features include automatic program execution at startup, property lists, extensive computational facilities and arithmetic functions, control over arithmetic precision and formatting, upper- and lower-case text, and comprehensive file and device handling. The file TOOLS.LF on the Logo Language Diskette contains a tool kit of procedures that make programming easier. The most important of these are the debugging procedures. Others, such as the syntax for creating comment lines in program state ments, are valuable, if not essential, aids.

Computer sophisticates will be especially grateful for IBM Logo's file-handling capabilities. The functions for reading and writing data files permit the use of random-access files by specifying the starting byte from which to begin reading or writing. This feature is one that makes this implementation of Logo suitable as a true general-purpose programming language.

This status is fortified by the greater amount of usable memory in the IBM Logo workspace. On an XT configured with 512K RAM, the numbers of nodes available—at 5 bytes per node—is about 30,000. Moreover, the internal stack and recursion algorithms appear to be extremely efficient. We were hard pressed to develop even a test program that ran out of memory.

Does this sound like a challenge? Well, in fact, it's an opportunity. IBM Logo is a mature language waiting to be used by the best and the brightest. ■

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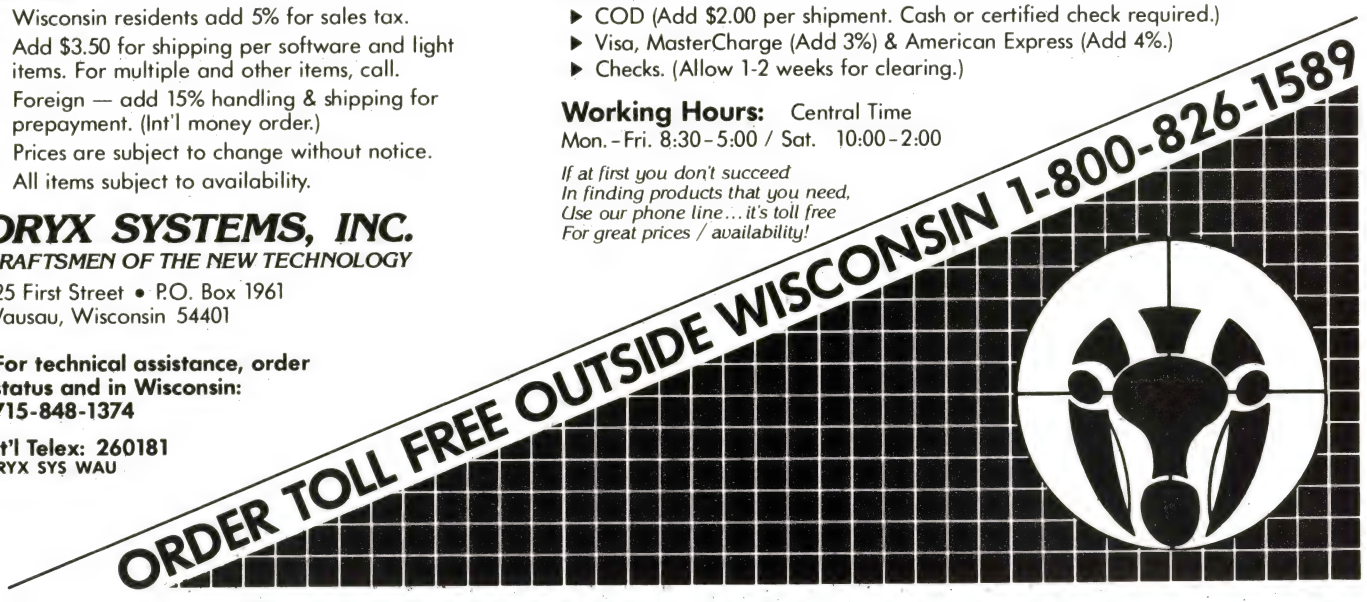
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# Free and Easy with Ladybug

This implementation of Logo will introduce you to the language for not much more than the cost of postage. It offers a "play" command and full ladybug (aka turtle) graphics.



**SPECIAL REPORT**
DARA PEARLMAN




Like many PC owners with young children, David Smith of Danbury, Connecticut, was excited about the educational potential of the computer language Logo and wished he could find a version to run on his computer. But unlike the rest of us, he went beyond wishing. About a year ago, before any commercial implementations for the PC were even on the horizon, Smith decided to write his own Logo so that his three children could "do something more creative with the computer than shoot down aliens."

Illustration: Earl Keleny

The result is Ladybug, a pared-down version of Logo that includes most of the "turtle graphics" commands, a text editor for composing Logo procedures, some mathematical functions and a series of music commands that control the PC's speaker.

Ladybug isn't in the same class as the full-fledged versions of Logo now on the market, such as *Dr. Logo* from Digital Research, Inc. It lacks many Logo capabilities, most notably list processing, the ability to manipulate sentences that allows Logo users to create "computer poetry" and write programs that include elements of artificial intelligence. And the version I reviewed still has a few not very ladylike bugs lurking here and there.

All the same, you can't beat the price. Following the lead of "freeware" pioneer Andrew Fluegelman, who wrote the popular communications program *PC-Talk*, Smith is offering Ladybug for free. If you want a copy, just send him a blank, formatted disk with a prepaid mailer (see the accompanying sidebar, "How to Get a Ladybug"). He'll copy the program and the text of a 51-page manual onto your disk and return it to you. You're free to make copies for your friends. If you like Ladybug, Smith is happy to receive concrete expressions of appreciation, preferably $35.

> Ladybug would be useful at the elementary school level where Logo classes focus on turtle graphics.

Ladybug isn't Smith's first foray into the freeware-style market place. He's also the author of a full-screen text editor called *FRED* (for Free Editor) available on many PC bulletin boards and in the CompuServe IBM PC Special Interest Group (SIG) library. If you send him a formatted diskette and a prepaid mailer, Smith will copy *FRED* onto your disk along with the necessary instructions.

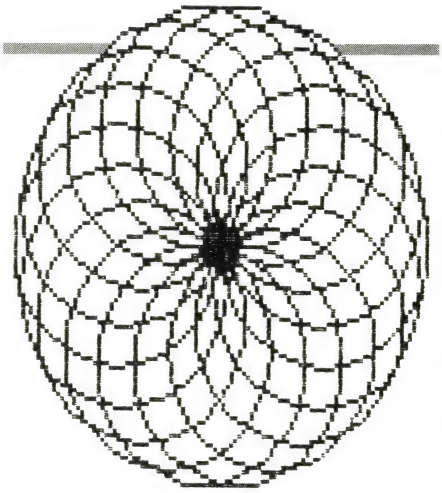


**Figure 1:** *An example of Ladybug graphics.*

In either case, there's no obligation to send money. In fact, Smith emphatically doesn't want to receive any checks along with requests for his programs. He's not selling, he insists, because that would entail sales tax and other complications. Each time you run it, Ladybug displays a friendly reminder that the author would appreciate a contribution. If you choose to ignore it, that's between you and your conscience. No lawyer will call.

If you're an educator, Smith doesn't even want your conscience to bother you. He relates that he recently received a letter from three teachers who apologized for not sending money, explaining that their software budget for the year was only $100. However, they continued, they would send the $35 after the school candy sale.

Smith nixed that. After all, the money he makes from Ladybug helps support his computer hobby, not his grocery bills. He makes his living writing computer programs for a large corporation and doesn't wish to divert money from good causes like education. He emphatically doesn't want to take any money from school candy sales. So if you use Ladybug in the classroom, Smith doesn't want you to pay for it.

## Ladybug's Fans

Perhaps you're wondering whether teachers would find much use for a limited version of Logo that concentrates mainly on graphics. Bobby Goodson, computer resource teacher for the Cupertino Union School District in California's San Francisco Bay area, thought that Ladybug would be very useful at the elementary school level where Logo classes concentrate on turtle graphics. But, she added, in junior high and high school classes, Ladybug's lack of list-processing abilities would be a significant drawback. Since few elementary schools buy IBM PCs, she thought Ladybug might make its biggest impact on young children whose parents own PCs.

Has Ladybug developed much of an audience outside of formal educational circles? Last September, at the urging of enthusiastic friends, Smith posted a notice on CompuServe that he would give away copies of Ladybug to anyone who sent him a diskette and a mailer. The response surprised him. In the first 4 months, he received some 150 requests for the pro-

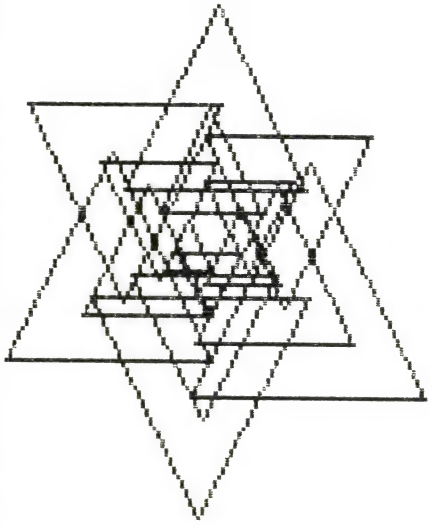


**Figure 2:** *A star figure drawn with Ladybug graphics.*

gram—many from bulletin board operators and club librarians, indicating that the program is reaching an even wider audience. The fact that Ladybug is still unfinished (version 0.9) and has some acknowledged bugs doesn't seem to have made a difference. Smith encourages people with questions or problems to write to him via the U.S. Mail via CompuServe EMAIL (user number 73145, 153). From users' comments, he concludes that version 0.9 is "surprisingly robust," with few undiscovered bugs.

Ladybug is an introduction to Logo that concentrates on Logo's famous turtle graphics—in this case renamed "ladybug graphics." In many of its details, Ladybug follows the Terrapin Logo for the Apple Computer. As a tutorial text, Smith recommends *Logo for the Apple II* by Harold Abelson (Byte/McGraw Hill, 1982, softcover, 227 pages, $15.95).

Ladybug is an introduction to Logo that focuses on turtle graphics, in this case called ladybug graphics.



## A Geometric Ladybug

When you start up the program, you'll see a triangle in the center of the screen. That's the ladybug. At the bottom of the screen is a question mark prompt, waiting for your command. You can move the ladybug around the screen with commands like "forward 50" or "right 90". The units for forward and backward motion are called "ladybug steps." The medium-resolution graphics screen is 500 ladybug steps wide and 300 steps high. The units for turning to the right or left are degrees. Thus, to reverse the direction of the ladybug, you type in "right 180".

The ladybug draws as she moves, unless you tell her to pick up her pen ("penup"). When you want her to resume drawing, you give her the "pendown" command.

Using Ladybug's text editor (a version of *FRED*), you can combine these commands into "procedures" that create intricate designs, such as the examples in Figure 1 and Figure 2. Seymour Papert, the inventor of Logo, contends that a child can get an intuitive feel for geometry and higher mathematics by experimenting with the turtle commands and learning how to create such designs.

Suppose you want to write a procedure to draw a triangle. You type the words "edit triangle" after the question mark prompt. In a flash, the screen will go blank. Then, at the top left corner of the screen, you'll see the beginning of your procedure, consisting of two lines: "To triangle", and "end". You then type in the rest of the procedure. The function keys let you do simple editing, such as deleting the current line, and the cursor control keys let you move the cursor anywhere on the screen. Figure 3 shows you the complete "triangle" procedure.

When you're satisfied with your procedure, you press F9; suddenly the editing screen is gone and the ladybug reappears. Now the procedure is part of Ladybug's repertoire, just as if it were a primitive command. Type in "triangle" and the ladybug will draw one.

If you've had experience with Logo turtle graphics, all of this should be familiar. Like Logo, Ladybug lets you use variables in your procedures and lets a procedure call itself, a process called "recursion." With these tools you can vary the sizes and angles of your shapes to create graceful spirals and sunbursts.

To help get you started creating your own designs, the Ladybug disk includes a library of ladybug procedures from a number of sources, including some of the procedures in Abelson's book. You should be able to draw your own ladybug pictures with very little practice.

In addition to repeating basic turtle graphics, Smith has added some elegant touches of his own. If you have an IBM monochrome monitor in addition to a color monitor, the text editor will work on the monochrome display, leaving your graphics undisturbed. If one of your procedures won't work, you can turn on a trace by pressing F9. The trace puts the ladybug into slow motion, displaying each command before the ladybug executes it. The program pauses at each command, letting you study the situation. To go on to the next command, you press any key; to turn off the trace, press F9 again.

```
To triangle:
right 120
forward 100
right 120
forward 100
right 120
forward 100
end
```

This procedure also draws a triangle, using the "repeat" command.

```
To triangle
repeat 3 [ right
120 forward 100 ] end
```

**Figure 3:** *A Ladybug procedure for drawing a triangle.*

Another nifty feature of Ladybug is its ability to play music with its "play" primitive.



### Ladybug Music

Another nifty feature of Ladybug is its ability to make music. Since Smith wrote Ladybug using compiled BASIC, he decided to create Ladybug's "play" command, which is identical to the corresponding command in BASIC. "Ladybug just hands the string to BASIC and says, 'Here BASIC, play that,' " Smith explains. He added this feature because it was easy to do and because he thought users might enjoy creating music and pictures at the same time. The Ladybug disk includes some sample Ladybug music. My favorite is a version of "I've Been Working on the Railroad."

In version 1.0, Smith plans to include a command called "tone" based on BASIC's SOUND statement, which will allow students to experiment with tones of different durations and pitches. Using program variables to change both elements, students will be able to explore the properties of music just as they explore the properties of geometric shapes with ladybug graphics.

If you want to stop your work and pick up again later, Ladybug lets you save your "workspace" to disk. The workspace includes all of the procedures you created during one work session, and the save command saves the entire workspace under one name with the extension "BUG." The next time you run Ladybug, you can read your old procedures and continue working.

If you want to save only part of the workspace, Ladybug includes some workspace management commands that let you erase a procedure or clear the entire workspace. You can also check the disk directory with a catalog command and delete files from the disk. Unfortunately, version 0.9 lacks a command to list the procedures currently in the workspace, so if you are working on a complex program with many procedures, you can sometimes lose your way. If that does happen, though, you can save the workspace to disk and then examine the file with the DOS TYPE command. Each procedure will begin with the word "define", followed by the name of the procedure. You can then write down the names of the procedures in the file.

In common with most programming languages, Ladybug includes program control commands such as "if-then-else" sequences and statements assigning values to variables. It can also perform simple arithmetic and such advanced functions as logarithms, trigonometric functions, and square roots. And it lets you pass values between procedures with an "output" statement, although in version 0.9 this feature was not in good working order.

### Ladybug Bugs

Version 0.9 has a few other troublesome bugs. For example, the "request" command, which reads input from the keyboard, refuses to accept alphabetic characters. Its insistence on numbers only makes it impossible to create word games with Ladybug. Also, the text editor didn't work properly when I tried to create a procedure with its name written all in caps.

These are minor irritants, however, and Smith promises to fix the problems in version 1.0. He will also make the program more compatible with IBM Logo.

Will Ladybug continue to grow after version 1.0? Smith doesn't think so. He points out that most implementations of Logo are written in LISP, the list-processing language that reigns as the favorite researchers in artificial intelligence. Ladybug, on the other hand, is written in compiled BASIC, and Smith thinks he's taken Ladybug as far as BASIC will let him go.

Smith doesn't expect Ladybug to compete with commercial versions of Logo. He predicts only that Ladybug will whet people's appetites for the real thing. ■

## How to Get a Ladybug

"Send no money" sounds like a come-on, but David Smith is absolutely sincere. For your free Ladybug, read on.

Send a formatted double-sided diskette and a postage paid mailer to:

David N. Smith
44 Ole Musket Lane
Danbury, CT 06810

David Smith asks that you write "LADYBUG" on the outside of your envelope. He also requests that you send no money. And please don't call. His wife works evenings during some weeks and sleeps during the day. If you also wish the text editor *FRED*, please send an additional diskette. Ladybug takes up most of a double-sided DOS 1.1 diskette. You can send questions to David Smith at his Danbury address or via CompuServe EMail at user number 73145, 153. **—D.P.**

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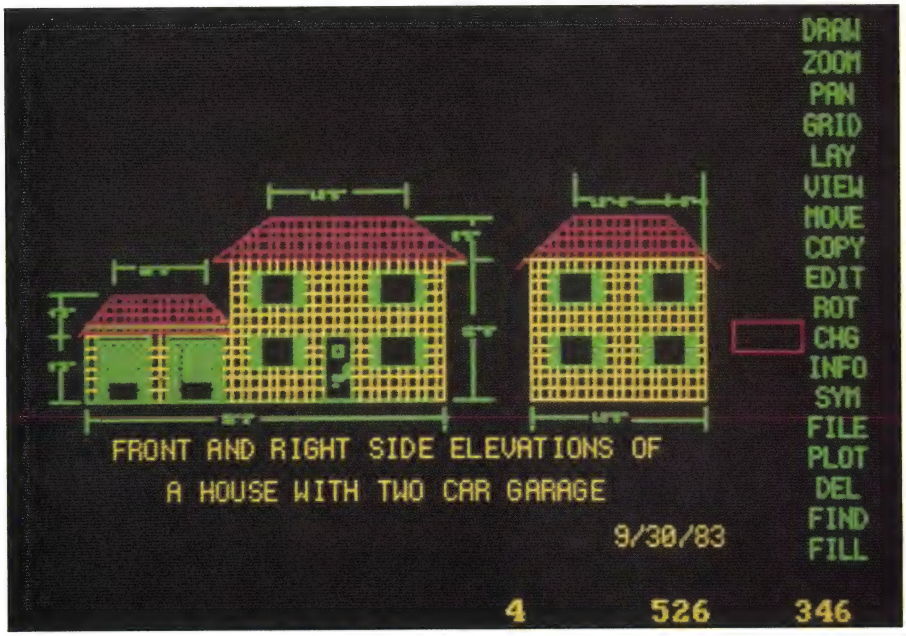
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**Requires:** 320K RAM, two double-sided disk drives, IBM Color/Graphics card, printer or plotter.

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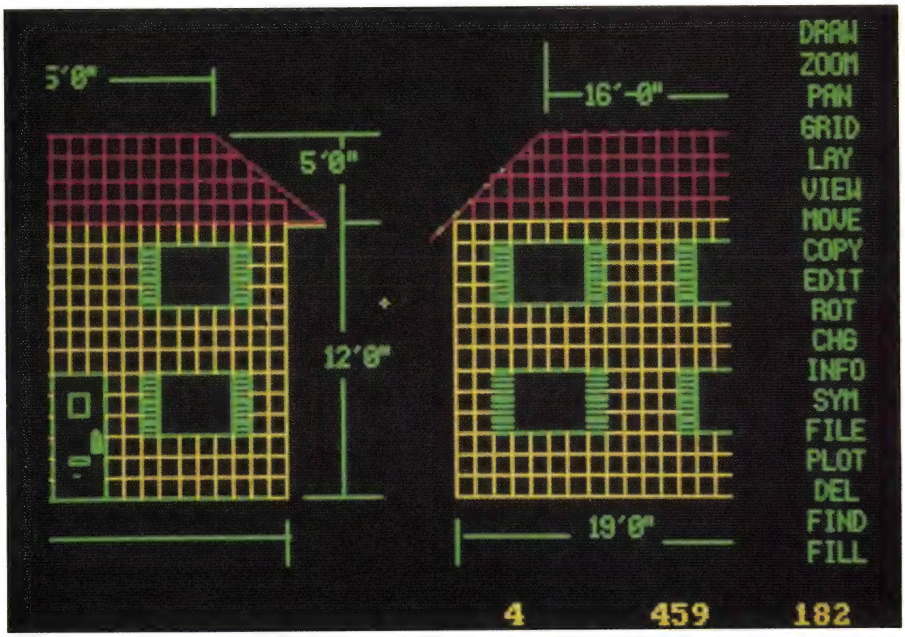
### CADplan in Action

Imagine a home improvements contractor who has to create a preliminary design for a new home addition and submit a bid to win the construction job. The contractor wants to spend the minimum practical amount of time designing the addition, but the accuracy of his cost projections can make the difference between running a successful business and facing eventual bankruptcy.

If our contractor is equipped with a PC and *CADplan,* the first step he will take in




***CADplan* makes it easy for architects, engineers, and contractors to create detailed house plans such as this one.**




***CADplan*'s optional Auto Dimensioning module in action. It automatically measures the distance between any two points you designate and draws the line.**

preparing a bid is to review previous projects to see if anything similar is on file. A major advantage of a CAD system is its ability to pull drawings that you previously created from disk files and allow you to modify them without harming or misfiling the original.

*CADplan*'s initial screen includes a menu of 18 commands. Subcommands associated with these first level commands control the system. Each command is described in a help file that you call onto the screen by pressing the question mark key. You can use a mouse, graphics tablet, or the arrow keys on the PC keyboard to select the File command from the menu. The Dir subcommand displays a directory of previously stored drawings. Unfortunately, the screen displays only the names of files without annotation, but if you are familiar with the files or keep notes on paper, then loading the data from a previous drawing is an easy job.

Say, for example, the contractor is bidding on a 14-by-16-foot room addition with a closet, bay window, and hip roof (a roof with sloping ends and sloping sides). He has in his file previously created drawings for a 12-by-12 room with a hip roof, but it has a wet bar as well as a flat window in the same place he wants to put a bay window. He calls the existing drawing into working memory so that he can modify it.

The contractor expands the drawing of the room from 12-by-12 to 14-by-16 with the *CADplan* Edit command. It is easy to make such changes in drawings, but the procedures differ for various kinds of rectangles, triangles, circles, and lines. This is one of the few places where the program can get in the way of the job instead of helping. Before you can edit a drawing, you have to figure out what *CADplan* techniques you used to construct the original. You can use the trial-and-error method to determine how to edit a specific drawing, but it is probably better to develop consistent techniques and stick with them. For example, always use line segments to draw walls instead of using a computer-generated rectangle.

The walls in the drawing that is to be modified can be changed with a technique called "rubberbanding." The ability to rubberband lines and figures makes *CADplan* simple to use and forgiving. When you draw or edit a line, angle, rectangle, or circle, you can literally pull and stretch it into the shape you want. The cursor latches onto a line or shape and pulls it around as if it were made from rubberbands. You can expand a rectangle from a single point into a large square that fills the screen or into a long, thin box. Rubber-

banding gives *CADplan* a major advantage over paper and pencil line drawing. It gives you control over the process and allows you to accurately position and dimension figures. This degree of control is missing from simpler programs.

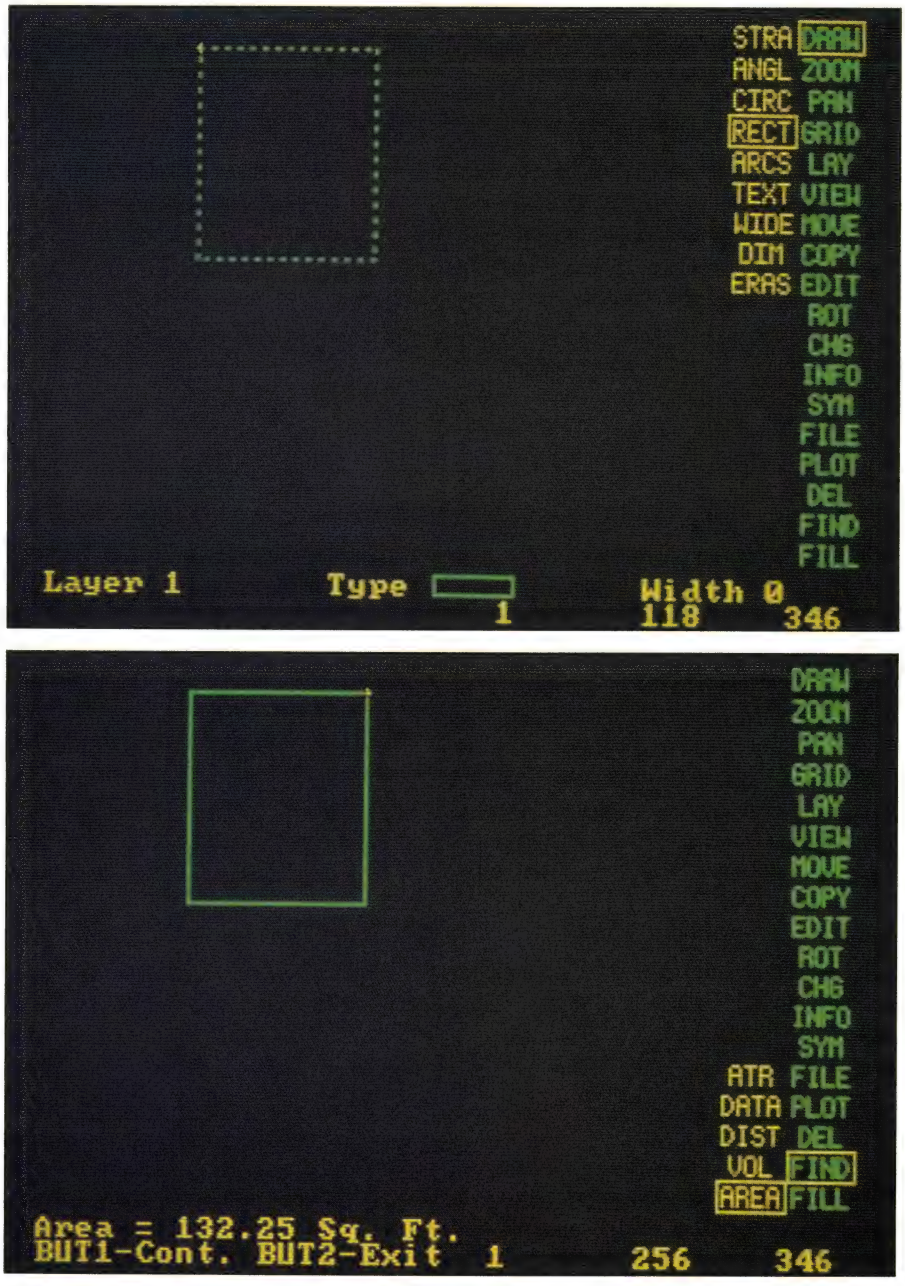
### The Layered Look

As our contractor edits the existing drawings, he makes several significant changes. The original drawings showed plumbing for the wet bar and sink. Because *CADplan* works like a set of standard blueprints, the diagrams for the plumbing are drawn on a separate layer of the electronic drawing just as they would be on a separate sheet of the blueline drawing. Separate layers would be used for the exterior walls, plumbing, electrical wiring, lighting, foundation, elevation, furniture placement, interior detail, and other building features. Each separate layer can be displayed, changed, or erased independently. Layers can be displayed in any combination to let you see how all or various parts of the figure fit together. The number of layers available depends on how much memory you have in the PC; a minimum *CADplan* system with 320K RAM can have up to 10 layers, and a 640K system can produce drawings with 65 layers.

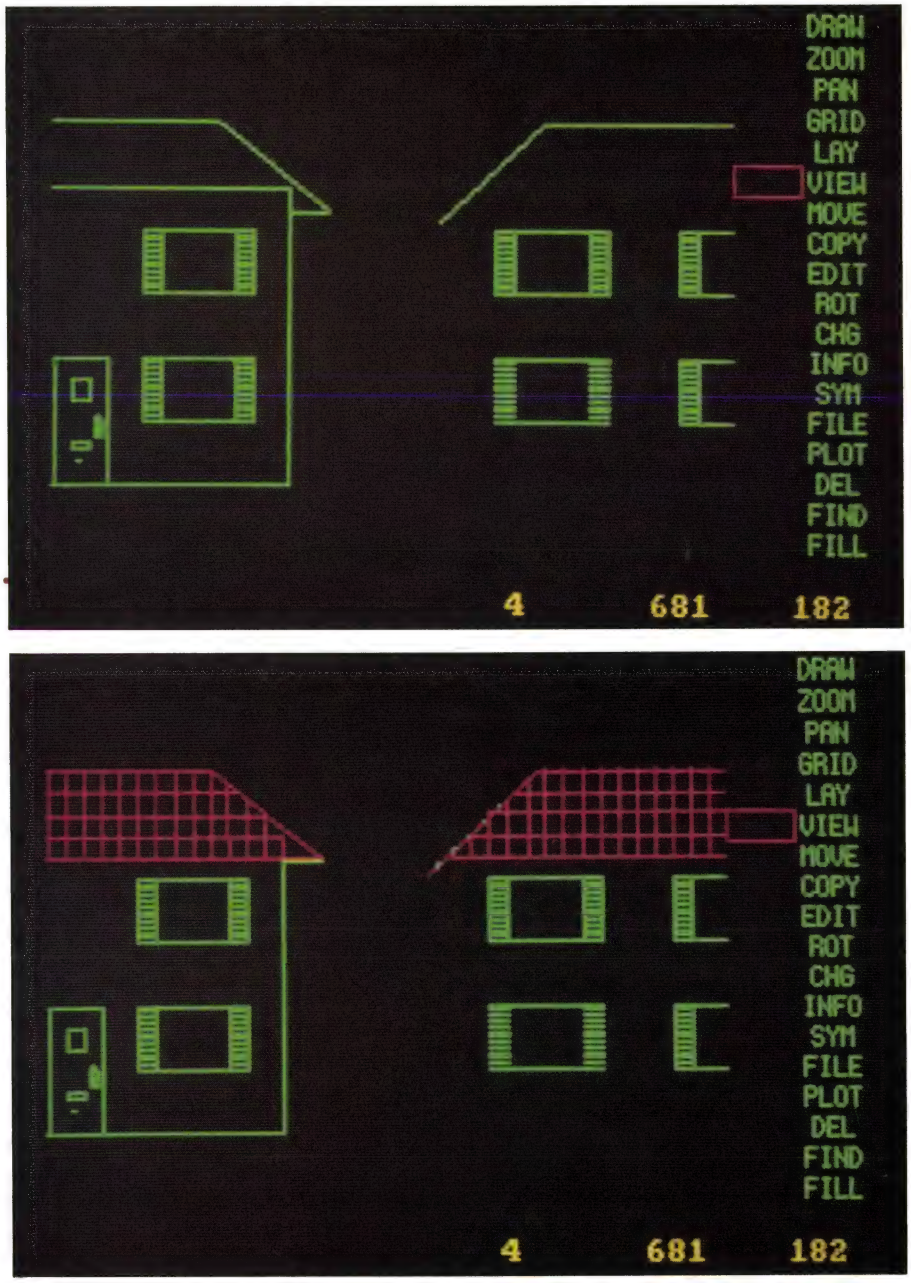
The contractor uses the View command to determine what layer the plumbing information is on (again, adopting standard practices would help), enters that layer with the Lay command, and erases the plumbing information. All the other layers remain the same. If he had wanted to retain some information on the plumbing layer, he could have used the cursor to draw a window around the area he wanted to erase.

He now converts the wet bar in the original plan into a closet by calling in specifications for a closet that he created previously and stored in a separate file along with drawings of porches, windows, and other structural elements a contractor often needs. The initial preparation of small files that hold diagrams you commonly use takes time, but you have to do it only once. After you create them, you can join common elements together in an electronic cut-and-paste that saves time and improves accuracy.

Two other *CADplan* functions make the program even more flexible and versatile. The Zoom command moves the view toward or away from a specific portion of a drawing. Zoom is complemented by the Pan command, which moves a drawing horizontally or vertically across the screen. While designing the new addition, the contractor might pan across the draw-




**Top: A rectangle created with the rubberbanding function and ready to be manipulated. Bottom: When you finish working with a shape and leave the rubberbanding mode, the sides of the shape firm up.**




**Two perspectives on a house in different stages of planning. *CADplan* lets you save and call up the various stages for later use.**

ing to find the portion describing the window and then zoom in to expand that detail on the screen.

The Zoom command moves in and out in steps of 2X power magnification. In a magnified mode, you can create text or figures that will not be legible when you have moved the view away from the drawing, yet they will reproduce properly when the drawing is sent to a plotter or printer. The Pan command lets you select a new center for the display. You can move the viewing screen in any direction across the drawing, but you must have the screen redrawn after each move, which means you can only jump the equivalent of one screen at a time. *CADplan* displays the X and Y coordinates of the cursor on the screen at all times. The screen shows about 600 vertical points and 840 horizontal points, and *CADplan* can create drawings with 60,000 points.

## In Another Dimension

The accuracy of a drawing's dimensions is important in almost all applications. *CADplan* provides accurate dimensioning with a flexible grid system that you can call onto the screen whenever you need it. Ten grids with different dimensions can be stored for recall. When the grid is on the screen, you can order lines and figures to align themselves to the nearest grid line. The *CADplan* manual says that the lines "snap to" the grid, and this is an accurate description.

An optional Auto Dimensioning module (available separately) can be integrated into *CADplan* to automatically measure the distance between two points you designate, draw the dimension line you want, and add text and numbers in a size you select. This module is very flexible; you can position text anywhere along the dimension line or allow the program to center the text on the dimension line for you. You can put text vertically or horizontally on any dimension line and define dimension lines with the cursor or by entering numbers representing specific coordinate points on the screen. You can also determine the number of decimal places the program uses when it labels the dimension lines.

> Rubberbanding gives CADplan a major advantage over paper and pencil line drawing.

The automatic dimensioning capability

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And all three monitors come with a non-glare screen and a shielded cable that plugs directly into the IBM PC or XT.

**The HX-12** has the highest resolution (690x240) and the finest dot pitch (.31mm) in its class. And yet its suggested retail price is comparable to many medium resolution monitors. The HX-12 brings no-compromise color to the PC and now, with the PGS RGB-80 board, to the Apple IIe as well. **Suggested retail price: $695.**

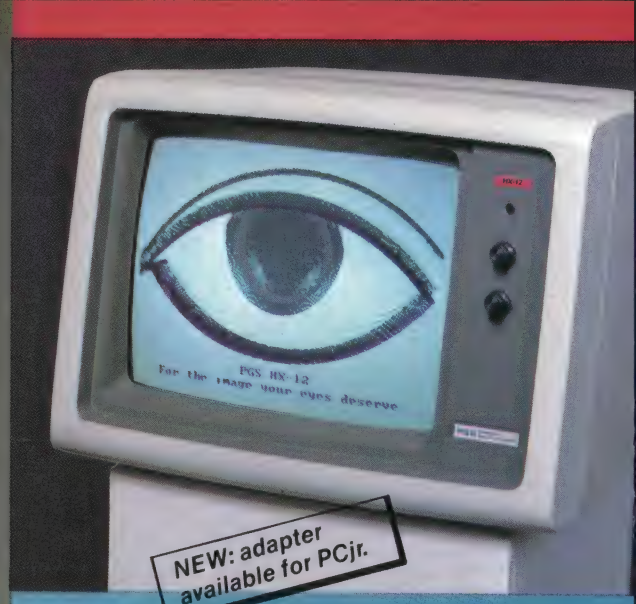
**The new SR-12**, in conjunction with the PGS high performance color graphics card, also features a .31mm dot pitch supporting 690 horizontal resolution. However, by increasing the horizontal scan rate to 27.5 KHz, the SR-12 can support 400 vertical resolution in non-interlaced mode. This results in a very high quality, flickerless image with the ability to generate graphics and text that is truly of monochrome quality. **Suggested retail price: $799.**

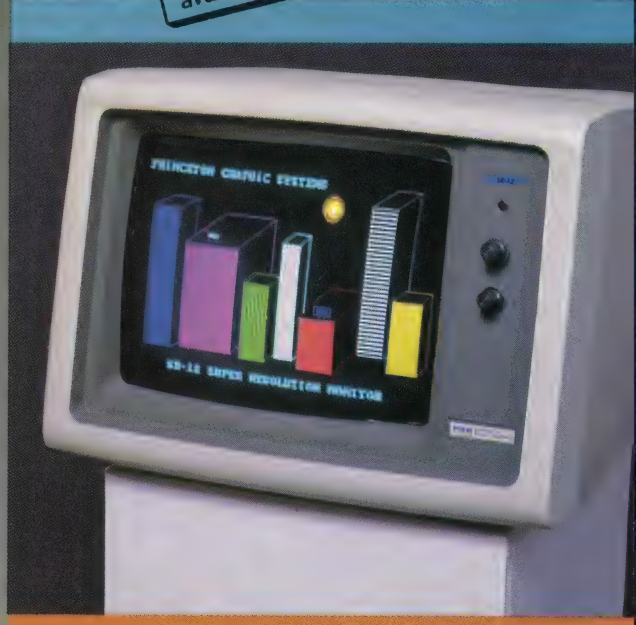
**The new MAX-12** offers you easy-on-the-eyes amber with 720x350 resolution at a suggested retail price ($249) that is actually lower than the leading green-on-black competitor. And the MAX-12 runs off the IBM PC monochrome card—no special card is required.

Clarity of the Max 12 is enhanced by dynamic focusing circuitry which ensures sharpness not only in the center but also in the edges and corners. **Suggested retail price: $249.**

Whatever your needs, from word processing to super resolution graphics, there's now a no-compromise PGS monitor that sets the standard. Ask your dealer for a demonstration and let your eyes decide. Or call for more information and the name of your nearest dealer.

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is a worthwhile addition to the *CADplan* package. Personal CAD Software's decision to market this module as a separate item may cause you to overlook its value, which is unfortunate.

Our hypothetical contractor should be about ready to produce his drawing. The primary output of almost all CAD systems eventually has to find its way onto paper, so the ability of CAD software to work with your plotter or printer is very important. *CADplan* supports nearly a dozen different plotters, and the Epson/IBM dot-matrix printer. The plotters that will work with *CADplan* include the most popular models from IBM (749 and 750), Houston Instrument, and Hewlett-Packard.

*CADplan*'s printing and plotting routines allow you to select various portions or layers of the drawings to reproduce. Since you can select the scale for each reproduction, you can easily produce blown-up views of a portion of the drawing. The *CADplan* interface with printers and plotters is both effective and simple to use.

## The Critical Step

The production of the drawing is an important step in the preparation of a bid, but eventually the critical question must be answered: How much will it cost? Every project, from small home improvements to the construction of nuclear power plants, has an informal or formal document called a "bill of materials" associated with it. The bill of materials tells you what parts and supplies you need to do the job and may include information on size, color, manufacturer, supplier, stock number, and price of each item. The bill of materials helps you determine what the project will cost, where the materials can be ordered from, and perhaps even when they should be ordered and in what sequence they should arrive.

The production of the bill of materials can be a tedious manual job, but a $350 optional module for *CADplan* called Data Base Extraction goes a long way toward automating this repetitive process. This module is properly designated as an option because while it is comprehensive, not all users will need it or choose to master the programming skills it requires.

## Adding Up

The concept used in this database program is that every symbol and line in a drawing can have certain attributes attached to it—such as size, weight, and color. (For an example, see Figure 1.) When you complete a drawing, it will contain important elements such as left-hand-opening doors, right-hand-opening doors, electrical wiring footage, plumbing, and perhaps hundreds of other items.

Our builder goes through his drawings; he counts the doors, windows and wires, compiles a list, writes a description for each item, finds the price of each, and computes the costs in various categories. Done manually, the job could take from hours to months and almost never produce a list current with the latest changes in the plans of a large project.

> The automatic dimensioning capability is a worthwhile addition to the CADplan package.

*CADplan* can, with some internal programming, perform all of these functions in minutes. Of course, all of the attributes associated with a symbol must be entered once and then be kept current. But if you have a big project or more than one project underway at a time, the benefit is worth the initial investment.

The Data Base Extraction module relies on two kinds of files. The first is a text file that contains the various attributes for each kind of figure and can be created easily with any word processor that creates standard ASCII files. Each major attribute is set off by two asterisks and typed in capital letters. As an example, the data describing where a contractor can order material might be:

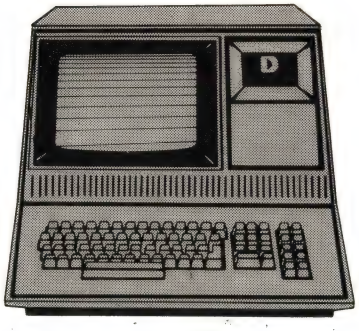
**VENDOR**
Acme Electric
123 45th Street
Bridgetown, Barbados,
West Indies

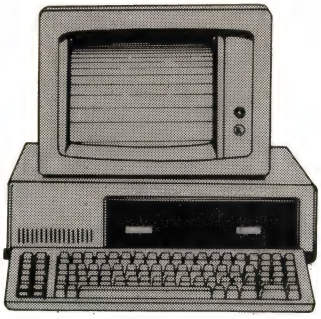
The extraction program will look for the attribute heading and withdraw the material following the heading.

The second type of file is a command file. Writing a command file requires the same programming skills you need to write a simple program in BASIC or Pascal, but the format of the command file is

```
**ITEM**
CREDENZA
**COST**
$454.33
**VENDOR**
Macy's
1 So. First St.
San Jose Ca. 96564
(408) 366-7776
**NUMBER**
1
**STYLE**
Oak wood, three sliding doors, 2 interior shelves
```

**Figure 1:** *This file holds the "attributes" or needed information describing a piece of furniture called a credenza.*

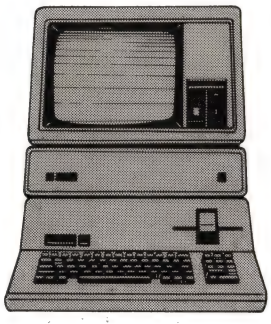




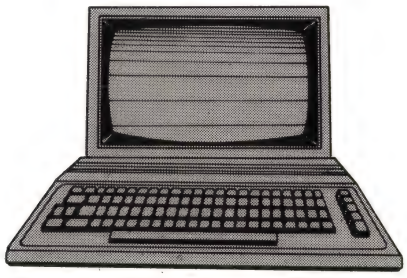


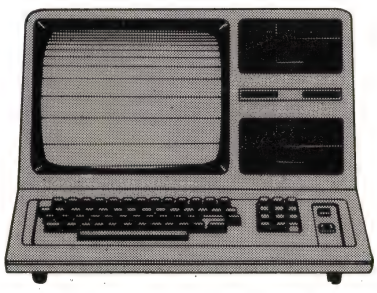


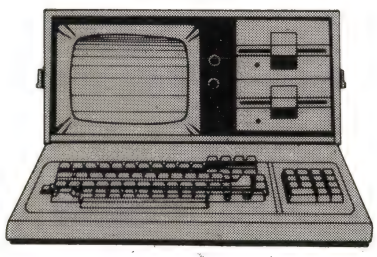
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```
        Listing of CADPLAN command file called :  DEMO

V       "This is a demo of various capabilities of "CADPLAN"
V       "You should have loaded NEWPCAD1 and windowed out an area"
V       "with 2 points, hereafter called P1 and P2."
V
V+      "The X distance between P1 and P2 is"[---DELTAX---]
V       "Feet"
V
V+      "The Y distance between P1 and P2 is"[---DELTAY---]
V       "Feet"
V
V+      "The AREA of the defined window is"[---AREA---]
V       "Square Feet"
V
V+      "Assuming 8 foot ceilings the volume is"[---AREA---] * 8
V       "Cubic Feet"
V
S   WALL=[---LAYER6---]
V+      "The total length of the walls on layer #6 is"[---WALL---]
V       "Feet"
V
V+      "Enter the cost of building the walls (per linear foot): "
S   WCST=[---INPUT---]
V
V
Vs      "The total cost of building the walls is"[---WALL---] * [---WCST-
```

**Figure 2:** *This listing shows a command file written using the* CADplan *Data Base Retrieval language. The commands are simple but not intuitive.*

not similar to either language. To use the command file capability, you not only have to learn the format once, but you have to review it unless you use the program frequently because of the number of commands, syntax, and alternatives in the command language. Any business electing to use *CADplan* with the Data Base option will have to institute a program to train and refresh employees in the use of the command language. The menu of commands to create drawings is intuitive, but the database command language is not. For example, a program that computes the cost of wire used in a building's electrical system contains seven lines of program code that contain brackets, asterisks, dashes, plus signs, and other symbols that do not have intuitive meanings (see Figure 2).

The merger of a database program and a drawing program gives *CADplan* a great deal of potential power. But the addition of a function generator or a menu-driven approach would make the Database Extraction module much easier to use and more valuable for users without programming skills.

## Bill of Materials

Our computer-assisted contractor has slightly modified the command file associated with his old drawing to account for the increased space. He has also run the file to produce a bill of materials and list of costs. He can prepare his bid by taking the costs and adding the overhead and profit he thinks the buyer will accept. The entire session took him less than half an hour (longer if many drawings were produced on a plotter), and the contractor now has a competent bid to present, accompanied by complete drawings and a bill of materials. This kind of bid is likely to inspire confidence in those who receive it and result in profitable rewards.

*CADplan* is not an inexpensive program, and it takes a well-equipped system to run it. The program eats memory like PacMan eats blue ghosts, so while 320K memory is the minimum, more memory is useful for complex projects. The main *CADplan* program is on a copy-protected disk and cannot be transferred to a hard disk, but The Data Base Extraction module can benefit from the fast access times a hard disk provides. Because of its intensive use of graphics, *CADplan* requires the IBM Color/Graphics card. Although it will work with a standard monochrome monitor attached to the Color/Graphics card, an RGB color monitor provides a much better display.

After I had used the program for several days, I installed a mouse. I was perfectly happy using the cursor keys to control the display. While the mouse did speed up the process by moving the cursor faster, I found that the keyboard didn't divide my attention among the screen, keyboard, and a third working area.

Personal CAD Systems claims that *CADplan* can be used with a digitizer system, which is a device that can trace existing drawings and select, or digitize, various points of reference for automatic entry into the computer. A digitizer is an effective but manually tedious method of entering into the system drawings that only exist on paper. Automated scanning systems for paper drawings are still on the drawing board.

*CADplan* can be an extremely effective tool for design projects, but like many good tools, it takes skill and practice to use it effectively. Some professional discipline is needed to ensure that users establish and follow standard practices. The manual provides only the fundamental information you need to use the program; it won't help you through the rough spots. Some editing techniques must be learned through trial and error. The Data Base Extraction module can add a useful function to the basic design program, but you need training and experience to use it effectively.

> When you complete a drawing, it will contain important elements such as electrical wiring footage, plumbing.

*CADplan* is a serious program for serious users. It can be an invaluable tool for people or companies that will make a commitment to using its power on a full time basis. ■



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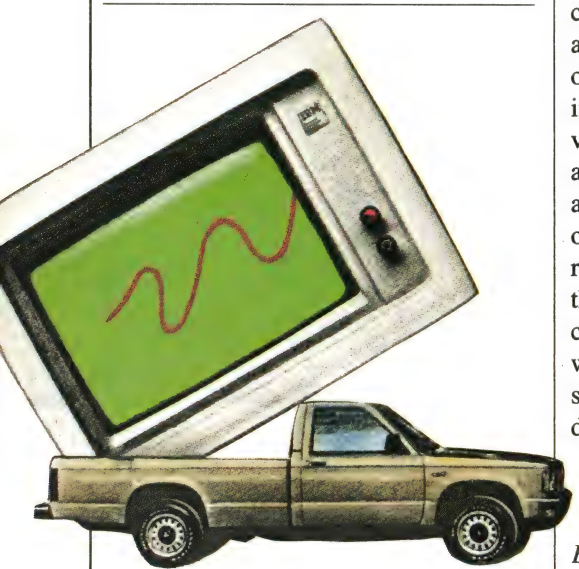
Marketed by Systems Plus, Inc., the package is based on The General Ledger Module, which serves as a foundation for a complete *BOOKS!* system. Four optional modules are available: Recurring Entries, Budgeting, Check Writing (which includes Accounts Payable), and Invoicing. These optional modules may be purchased independently.

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Illustration: Carl Wesley

Most small business accounting packages for the PC process subsidiary transactions, which are then summarized and passed on to a separate general ledger. For instance, you may buy a system that can process order, invoice, and payment transactions, the financial impact of which is summarized and passed on to a separate general-ledger system.

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As illustrated in the sample screens accompanying this review, *BOOKS!* continually reinforces the general ledger orientation. Whether you're entering a journal or requesting that a check be printed, you are always using the same ledgerlike screen format. To quote the *BOOKS!* manual, "The screen display that you will use to make your journal entries looks like the page from your journal book, making your transition to electronic accounting faster and easier."

## Starter Charts

When you purchase *BOOKS!*, you receive a "charts" disk, which, among other things, contains ten predefined charts of accounts (that is, general-ledger accounts). Charts tailored for seven types of businesses—construction, manufacturing, professional services, repair and service work, retail sales, wholesale sales, and personal—are included on the disk, along with a master chart, a program demonstration chart, and a bookkeeping tutorial chart. The master chart includes all of the accounts that are on the "custom" charts. The program demonstration chart, which is used with the system's demonstration booklet, gives a thorough introduction to the system. The bookkeeping tutorial chart is for use with the short written tutorial on basic accounting, which you will find included in the *BOOKS!* manual.

These predefined charts can be a great help in setting up *BOOKS!* for your business. You can select the chart that most closely resembles the chart of accounts you need and modify it accordingly.

Setting up a chart for *BOOKS!* entails more than simply entering new account names. For each account, you must specify where it "fits" into the predefined balance sheet and income statement. You can also specify whether each account is usually a debit or a credit amount to speed the entry of journal transactions.

Another unusual feature of this program is that it doesn't use account codes. Instead, you simply move the cursor to the account title and hit the Enter key to specify an account.

*BOOKS!* uses a three-level chart of accounts. The major account headings are called summary accounts; below summary accounts you can define intermediate accounts, and below them, subsidiary accounts. This structure makes it easier for you to summarize and report accounting records and lets you maintain subsidiary records for accounts receivable, accounts payable, and job costs.

Both the balance sheet and income statement list only summary level accounts, which must be set up accordingly. For example, the model charts each contain a summary account for Payroll Insurance and Taxes, with intermediate accounts for Social Security Tax, State Unemployment Tax, Federal Unemployment Tax, Workmen's Compensation Tax, and Hospitalization Insurance.

This arrangement provides you with the necessary (intermediate) level of account detail, but only the summary account will be reported in your financial statements. In this scheme, entries are made only to the intermediate accounts. *BOOKS!* will automatically total the intermediate accounts to generate summary level financial reports.

You can maintain subsidiary ledger accounts by establishing appropriate summary and lower level accounts. For example, the *BOOKS!* demonstration chart has the following accounts:

ACCOUNTS PAYABLE
AMF Voit, Inc.
  Invoice Received
  Payment Made
  Merchandise Returned
Hoerster Supply
  Invoice Received
  Payment Made
  Merchandise Returned
New Balance Company
  Invoice Received
  •
  •

By directing your general journal Ac-

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CIRCLE 266 ON READER SERVICE CARD

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**Diablo Printers**

CIRCLE 130 ON READER SERVICE CARD

counts Payable entries to the appropriate intermediate and subsidiary accounts, you can keep track of obligations due and payments made to various vendors. To accommodate check writing, you can enter and maintain vendor address information for each of these accounts. *BOOKS!* is a far cry from a full-fledged accounts payable system, but it should meet the needs of many small businesses.

### Through the Ledger

The *BOOKS!* accounting modules lead you through each step necessary to process an entry with a series of prompts and menus, which are always presented on the lower left-hand quadrant of the screen. To select menu options, you use the arrow keys to move the cursor to the appropriate line and hit the Enter key to see the results of your choice.

Anyone familiar with Lotus' *1-2-3* will recognize this approach. With *1-2-3*, you can also make a selection by typing the first letter of the menu option you choose. Unfortunately, *BOOKS!* doesn't provide this convenience.

On the brighter side, an alternate method can be used to select an account. Before entering an account, the list of accounts appears in the lower right-hand corner of the screen. You can either move the cursor to the proper account title and hit the Enter key, or begin typing the account name. As you type the letters, the system further matches the account name with the list of existing accounts. Soon the cursor will be resting on the proper account name and you can then hit enter. This saves a great deal of time when making journal entries.

The authors of *BOOKS!* went out of their way to ensure that the system keeps you informed about what you're doing, and in what context. Figure 1 illustrates how this is accomplished. Let's say, for example, that you have just received a shipment of water skis from Orlando Water Skis, and you're accounting for your business on a cash basis (which means you're not using accounts payable). As you can see in Figure 1, it's clear that you're on the "Make Journal Entries" module of the *BOOKS!* system. Having decided to prepare journals, you then selected the "Make Entries and Write Checks" option to record the transaction and prepare a check. You choose the "Prepare Non-Payables Checks," which indicates that this check will *not* be in payment of an existing amount due your vendor (Orlando Water Skis). After recording the purchases, totaling $1,300, you selected "Complete the Balance of This Check" and further chose to "Enter a Discount."

A unique approach to bookkeeping makes Books! an ideal package for businesses converting from a manual to an automated system of accounting.



You are now poised to enter a discount, and the system is offering you the choice of doing so as a percentage or as a dollar amount.

As Figure 1 illustrates, your trail of menu selections is maintained on the *BOOKS!* display screen. About 20 percent of each screen is used to display messages to the user. This is another feature that makes this system so easy to use and reflects the thoughtfulness of the program's designers.

### Software Protection

When you purchase the system, you receive a complete set of software, whether or not you paid for all of the modules. The dealer gives you a 15-character code, which is a function of the modules you've paid for and the serial number of your copy of the program. To actually use the software, you have to "de-encrypt" it by entering this code, which causes the system to "unlock" the *BOOKS!* software you purchased.

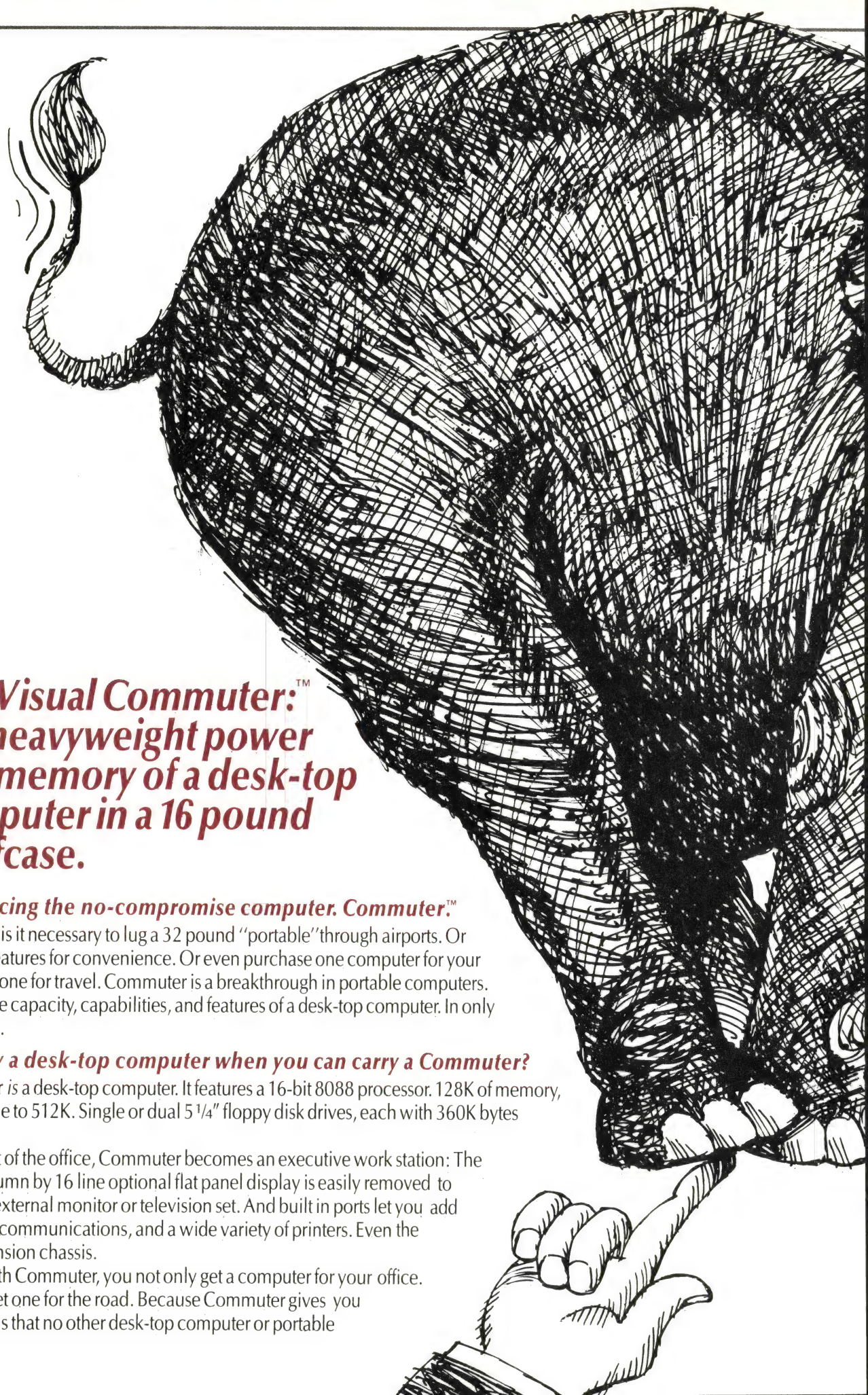
Unfortunately, the poor documentation that comes with *BOOKS!* made de-encrypting the software impossible until a representative of Systems Plus explained the process, step by step, over the phone. Once explained properly, it's not difficult; the process is similar to the installation procedures for a word processor or database system.

You *can* access optional modules you haven't paid for, but *BOOKS!* won't let you enter amounts over $99.99. This is Systems Plus' way of giving you a demonstration of the package's options and showing you the program's additional capabilities. When you purchase additional modules, your dealer will give you a new code to access them, and, once de-encrypted, they will be automatically updated with information from the general ledger.

### Productivity Boosters

*BOOKS!* provides you with several convenient features aimed at increasing your productivity. You can set up "abbreviated" charts of accounts that list only the most frequently used accounts. For example, when you're paying monthly bills, you may want to use an abbreviated chart consisting only of your usual monthly expense accounts. This saves you the time and trouble of picking your way through the entire chart. If you don't find an account you're looking for on the abbreviated list, you can hit the Esc key to access the entire chart.

Another timesaving feature allows you to establish what *BOOKS!* calls "following accounts." When entering journals, you can often predict the next account(s) needed to complete a journal. "Following



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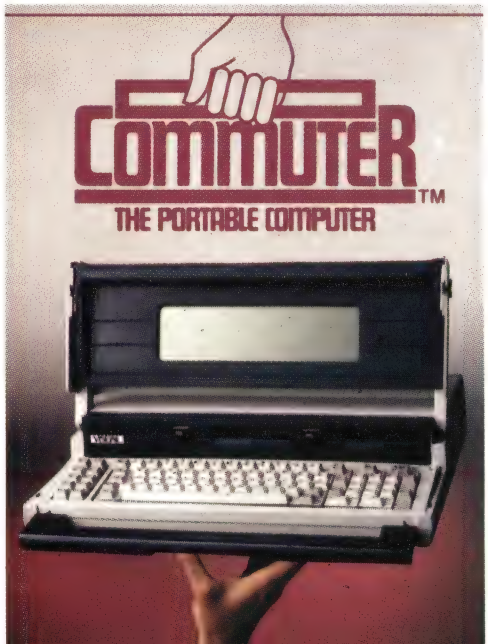
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CIRCLE 197 ON READER SERVICE CARD

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accounts'' lets you identify ahead of time one or more accounts to be presented by the system after using a certain account. For example, you might develop your cash accounts as follows:

CASH
Springfield Marine Bank
Deposits
Withdrawals

If so, you may want to specify that, following your use of the Deposits account, the system should present the following list of accounts:

SALES
ACCOUNTS RECEIVABLE
INTEREST INCOME
OTHER INCOME

Using this facility properly will probably save you time and reduce errors, too.

*BOOKS!* allows you to define one or more ''recurring'' journal entries. You can enter these ''standard'' journals just once, give them a unique name, and call them up each month for entry into the new journal. This is a convenience feature; if the amounts of the entries change, all you do is enter the new amounts prior to posting.

Another handy feature of *BOOKS!* allows you to annotate each of your ledger entries with an unstructured comment of up to 512 characters. This can considerably improve the clarity and comprehensiveness of the journal entries in an audit trail report.

*BOOKS!* has only a limited capability for developing reports in formats other than the standard formats supplied with the system. But the system's ''undefined reports'' only provide for listings of selected accounts and their respective balances, which must be listed in the order in which they appear in the chart. This feature is not all that useful, since one of the standard reports allows you to print (to paper or disk) accounts and balances, anyway.

There is a way to customize reports. *BOOKS!* allows you to ''print'' any of your reports to a disk file. You can then read these reports into your word processor or spreadsheet program. When you install the software, you can request that these reports be placed on your disk either in ASCII format or as document files for use with either *WordStar* or *Spellbinder*. This feature lets you customize the format of financial reports on your word processor.

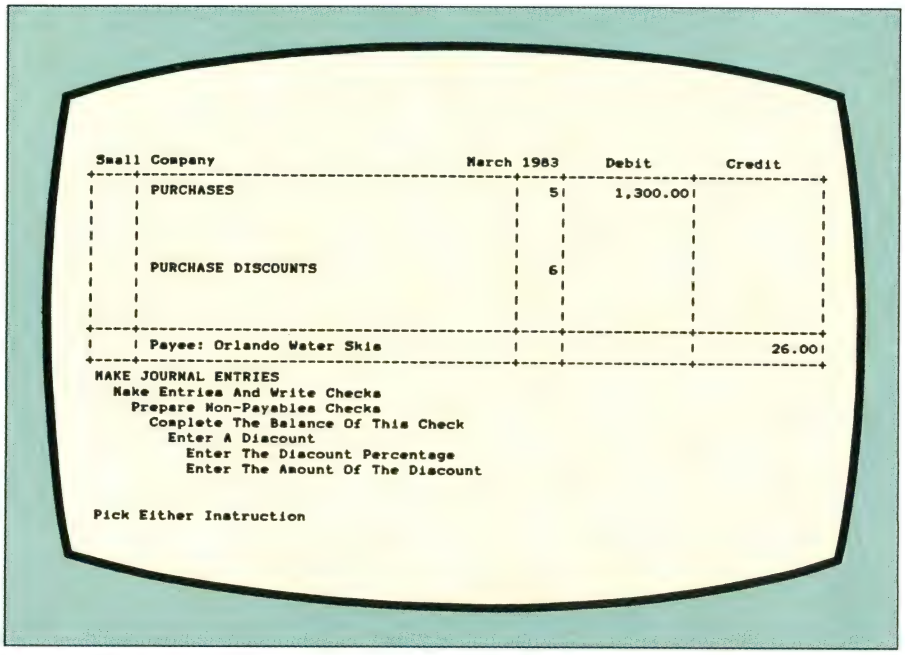



**Figure 1.** *When making entries,* BOOKS! *continually reminds you of what you're doing as it prompts you for the next response.*

If you choose to purchase the *BOOKS!* invoicing module, you will be able to develop sales invoices as you enter sales transactions into the ledger. This is done within the context of the general ledger.

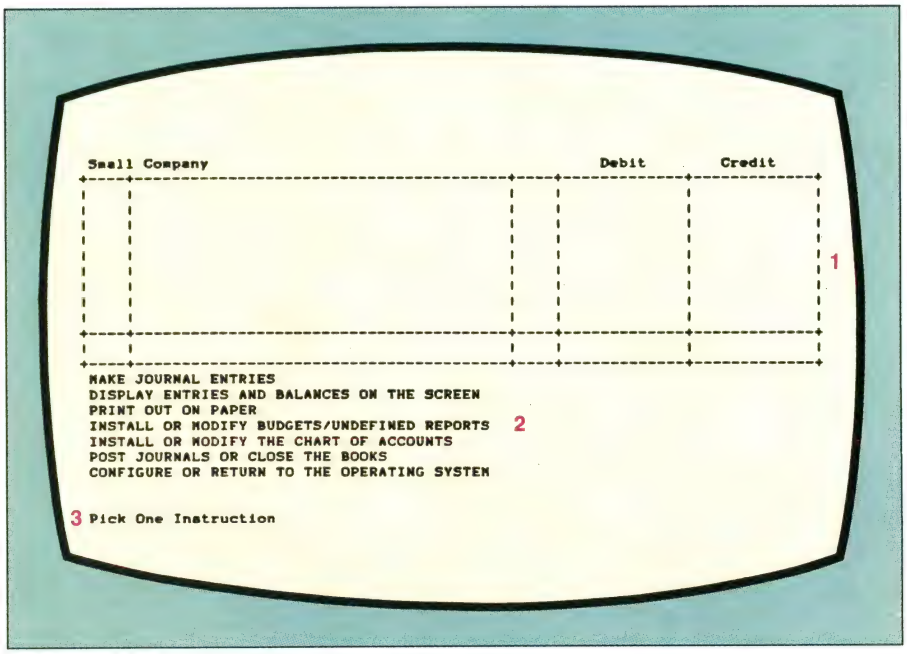
Invoicing is done as follows. After choosing the ''Make Entries and Write Invoices'' option and making the appropriate journal entry to record a sales transaction, you are prompted to enter the additional information needed to complete a sales invoice. You can create invoices either for the sale of product or for services rendered, which are then printed on special forms available from Systems Plus. Like other *BOOKS!* reports, invoices have a fixed format.

The sale can be charged to a specific customer account—that is, if you've set up the customer as an intermediate or subsidiary account of, say, the accounts receivable summary account. Payments received will then be credited to the customer's account.

If you need an invoicing or accounts receivable capability and you're considering *BOOKS!*, look carefully at exactly what these modules will and won't do. If your needs are simple enough—great. But don't expect your general ledger to blossom into a full-featured order and invoicing management function. It won't.

The *BOOKS!* budgeting capability is unique. Most microcomputer systems that provide for budgets simply allow you to enter, maintain, and report budgeted amounts for each general-ledger code. *BOOKS!* allows you to set up multiple budgets, each one for a group of accounts. You can budget at the summary, intermediate, or subsidiary level, but for any given multiple budget all accounts must be at the same level. Each budget is given a descriptive name and can be used to generate budget listings and variance reports.

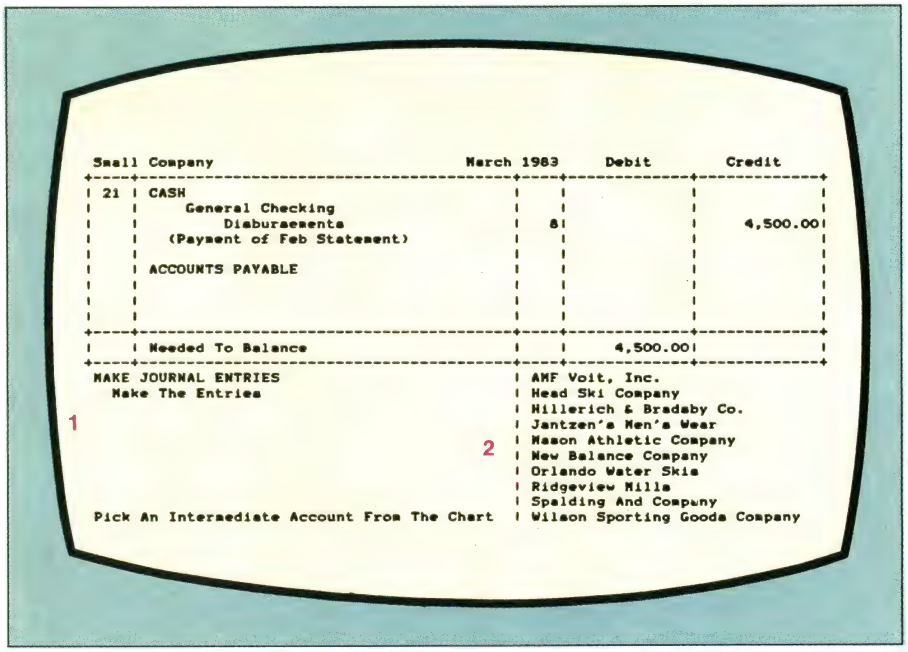
The nicest thing to be said about the ease of learning and using *BOOKS!* is that it can be done in spite of the documenta-




1. *This ledgerlike display format is used throughout the system.*

2. *This is the main menu of* BOOKS!. *Most day-to-day work is done with the "Make Journal Entries" option.*

3. *Prompts always appear here.*




1. *You can enter a remark of up to 512 characters under each journal entry.*

2. *This company has set up its vendors as intermediate accounts, subsidiary to Accounts Payable. This will allow the company to track obligations due and payments made to each vendor. For each of these accounts you can enter address information, which will be used for check writing purposes.*

tion. Inaccuracies abound throughout the "preliminary" manual. A number of the display screens offer choices that are not illustrated or explained in the manual. And even though the manual discusses how to print customer statements, the program wouldn't do it. Systems Plus supplies a mail-in order card to purchase forms designed to work with the system. Yet Systems Plus personnel admitted that some of the forms it has available, including the checks, won't work with the system we tested.

The folks at Systems Plus have been scrambling to improve the manual, and better documentation should be available soon (if it's not already).

There is one problem that should be classified as a "bug" in *BOOKS!* The problem can be especially distressing if you use an XT with no printer interface card. Some of the programs within the "Display Entries and Balances" module—which is used to display account data on the screen—call for the printer to be in "ready" state. These functions have no need for the printer, yet they didn't operate without access to one. Disturbing as this was, it should be only a minor inconvenience to most users.

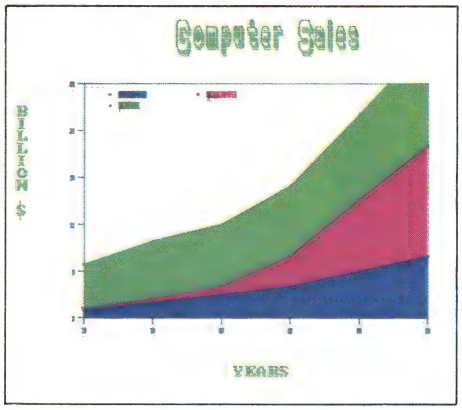
You have to keep your disk drives ready when *BOOKS!* wants them, too. Otherwise, the screen display may shift up two rows, causing the headings on the ledger display to disappear.

*BOOKS!* can be run on PC with 128K RAM and two floppy disk drives. The entire system contains about 400K bytes of code, which won't fit on one floppy disk, so some disk swapping is required. It does access the disks quite a bit, and it operates a lot faster on the XT.

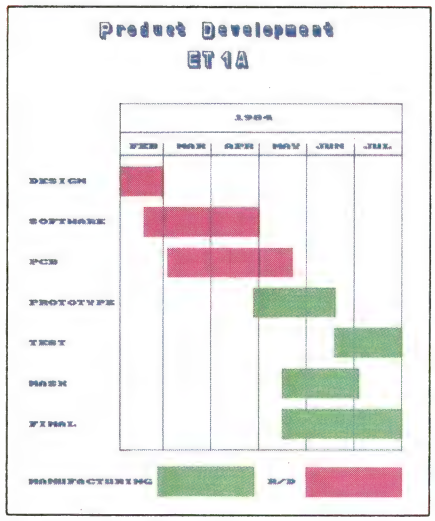
*BOOKS!* is an appealing, automated ledger designed for simple bookkeeping activities that focus on the general ledger. All of the frustration resulting from its less-than-friendly documentation is outweighed by its overall ease of use. Its simplicity and its unique approach may make it just the right accounting system for your business.—**G. William Dauphinais**

# WHEN SPREADSHEETS DON'T GIVE YOU THE PICTURE...

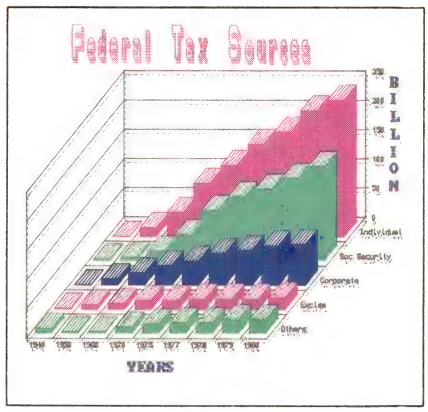
**LINE CHARTS**
**STATISTICS**



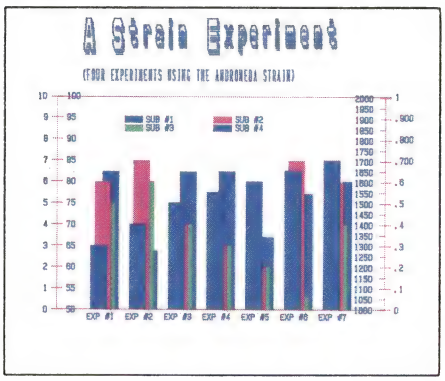

**GANTT CHARTS**
**PROJECT SCHEDULING**



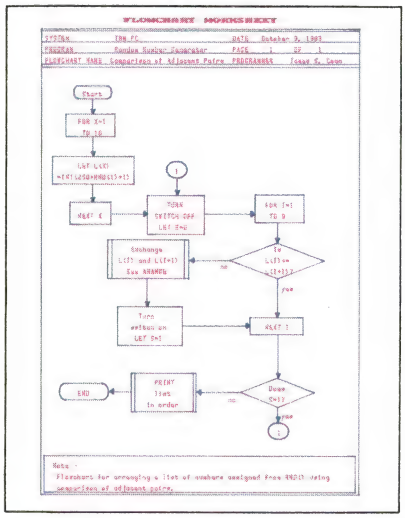

**3-DIMENSIONAL**
**BAR CHARTS**



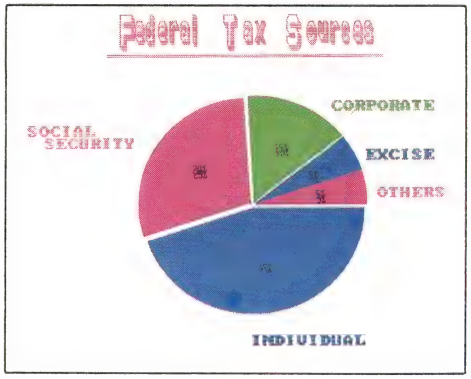

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**NEGATIVE BAR CHARTS**




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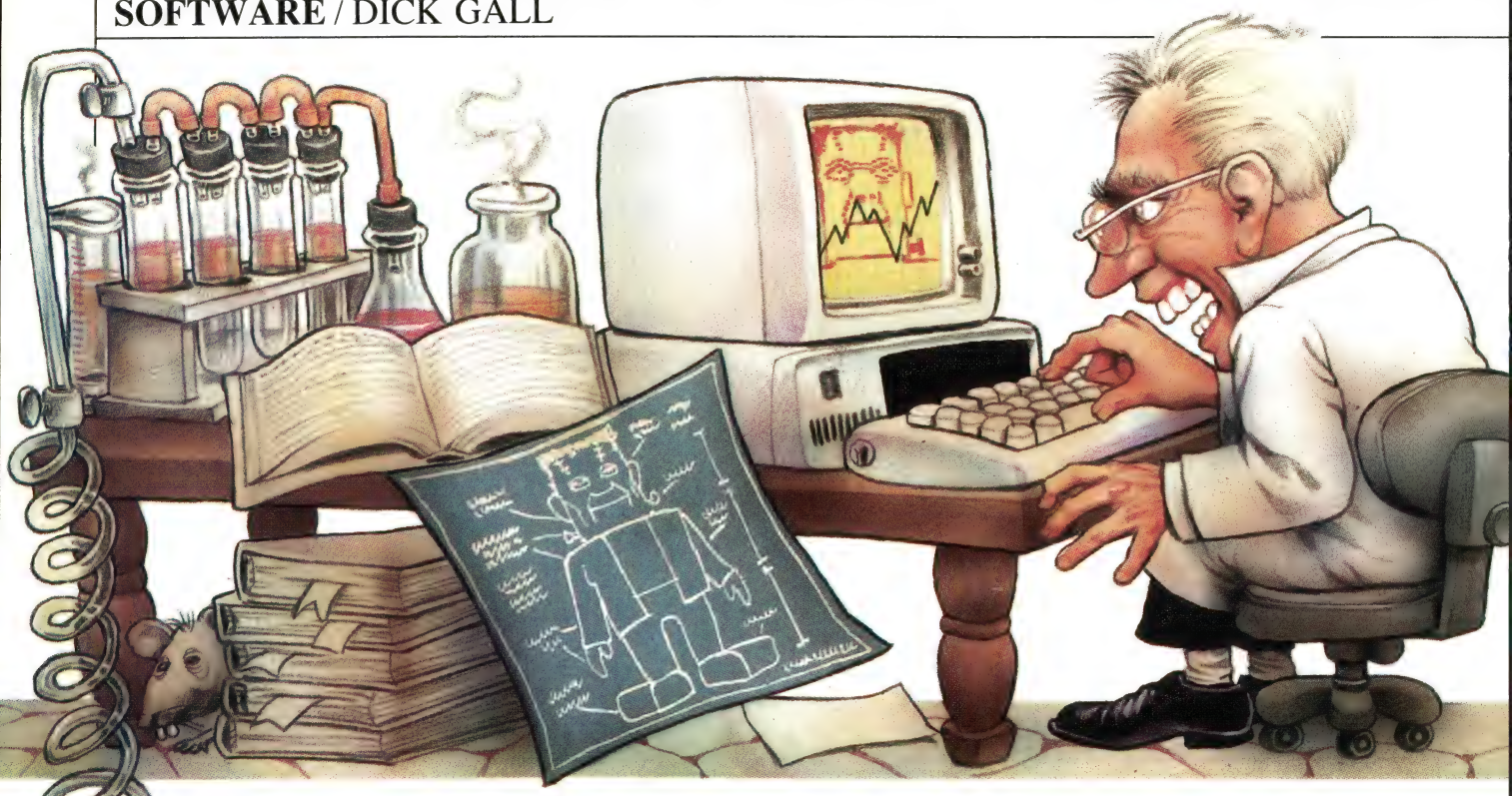
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# A Plot Fit For A Scientist

The Data Evaluation Program helps scientists and others plot and graph data, compare different sets of data, and find the mathematical model to best fit a given data set.

Scientists and others who use the computer for experimental and research purposes are often faced with the difficult task of converting raw data into a significant form and presenting the results in useful graphs and reports. The *Data Evaluation Program for the IBM Personal Computer (DAEPPC)* from R & L Software can do just that. It employs a coordinated set of routines that can evaluate the relationship between input data and mathematical models, determine the optimum equation form for representing a set of data, and graph the results. It can also provide statistics on the accuracy of its own work.

*DAEPPC*'s chief applications are in the sciences, and the program operates on three levels, each of which helps scientists perform a variety of tasks. The first level allows you to graph numerical data from a particular type of study or investigation. Data presented as single values can associate a set of numbers with each of several items—for example, the population of major cities in the United States as reported in the 1980 census. Comparing a second set of observations with the first reveals any changes in the data, but doing so requires that you use two values for




each item. To show which cities are growing, you would need to compare the 1980 census with the 1970 census. *DAEPPC*'s plotting capabilities can graphically illustrate this type of information.

Many scientific experiments attempt to confirm known physical laws as an educational process. Beginning physics students, for example, might measure the time it takes for a pendulum to make a complete back-and-forth oscillation. They could use *DAEPPC* to graph a set of data points that would indicate time measurements for different pendulum lengths. For comparison, calculations using the known equation of pendulum motion provide the theoretical period of oscillation values. In its second level, DAEPPC can contrast the calculated theoretical values with the measured data. At the third level—where only measured data is available and the governing physical equation is not yet known—*DAEPPC* demonstrates its greatest power. Here, it can quickly test a variety of mathematical models to determine which one best fits the data, and therefore which equation form the actual governing equation is likely to take. This iterative process uses the extensive calculation abilities of the PC to its best advantage; the computer easily performs an otherwise difficult, tedious, and frustrating job.

***Data Evaluation Program for the IBM Personal Computer***
R & L Software
1299 Beacon St.
Newton, MA 02168
**List Price:** $250
**Requires:** 128K RAM, BASICA, one single-sided disk drive, color/graphics adapter

CIRCLE 736 ON READER SERVICE CARD

DAEPPC's greatest power is that it can quickly test a variety of mathematical models to determine which one best fits the data.

## A Physics Lesson

Figures 1 and 2 illustrate an application of *DAEPPC* to the pendulum case. For small oscillations, the period of a simple pendulum can be approximated as:

$$T = \sqrt{\frac{l}{g}}$$

For $T$ in seconds, $l$ is the pendulum length in feet and gravity's acceleration $g$ is taken as 32.2 ft/sec$^2$.

The purpose of this example is to describe the period of oscillation of a pendulum as a function of its length. The column X-OBS in Figure 1 indicates ten different pendulum lengths, and Y-OBS gives their period of oscillation, calculated

Illustration: Mike Okamoto

using the above equation.

The X-OBS and Y-OBS values are input to *DAEPPC* as observed data. The last four columns of Figure 1 show the results of two *DAEPPC* curve-fit runs. The first attempt used a linear model, $y = mx + b$, and the percent deviation column shows that it had moderate success in predicting the input $y$ values, achieving an overall variance of 0.07. The second attempt used a third-order polynomial model, $y = ax^3 + bx^2 + cx + d$. Here, the calculated values are much closer to the input values, and the variance has been improved by almost a factor of 100 to 0.0008.

Figure 2 is a plot of the above data; it graphs the accuracy improvement achieved with the third-order polynomial model. The linear model is a fair representation of the data, but the exponential model points are almost indistinguishable from the original data values.

Once you are familiar with the program entering the input values, making the two *DAEPPC* runs, and printing the results takes about 10 minutes—a modest investment considering the usefulness and accuracy of the results.

| | INPUT DATA | | LINEAR MODEL | | POLYNOMIAL MODEL | |
|---|---|---|---|---|---|---|
| | PENDULUM LENGTH-FEET | PERIOD TIME-SEC. | Y = MX + B | | $Y = AX^3 + BX^2 + CX + D$ | |
| PT. | X-OBS | Y-OBS | Y-CALC | %DEV | Y-CALC | %DEV |
| 1 | 5. | 2.4800 | 2.9849 | 16.92 | 2.5070 | 1.08 |
| 2 | 10. | 3.5000 | 3.5578 | 1.63 | 3.4605 | -1.14 |
| 3 | 15. | 4.2900 | 4.1307 | -3.86 | 4.2724 | -0.41 |
| 4 | 20. | 4.9500 | 4.7036 | -5.24 | 4.9647 | 0.30 |
| 5 | 25. | 5.5400 | 5.2765 | -4.99 | 5.5598 | 0.36 |
| 6 | 30. | 6.0600 | 5.8495 | -3.60 | 6.0796 | 0.32 |
| 7 | 35. | 6.5500 | 6.4224 | -1.99 | 6.5463 | -0.06 |
| 8 | 40. | 7.0000 | 6.9953 | -0.07 | 6.9820 | -0.26 |
| 9 | 45. | 7.4300 | 7.5682 | 1.83 | 7.4089 | -0.29 |
| 10 | 50. | 7.8300 | 8.1411 | 3.82 | 7.8490 | 0.24 |
| | | | FINAL PARAMETER VALUES | | | |
| | | | M = 0.1146 | | A = 2.95104E-05 | |
| | | | B = 2.4120 | | B = 3.71795E-03 | |
| | | | | | C = 0.2413 | |
| | | | | | D = 1.3897 | |

**Figure 1:** *Input data and numerical results from two curve-fit runs show that a polynomial model is better than a linear model for modeling pendulum oscillation time.*

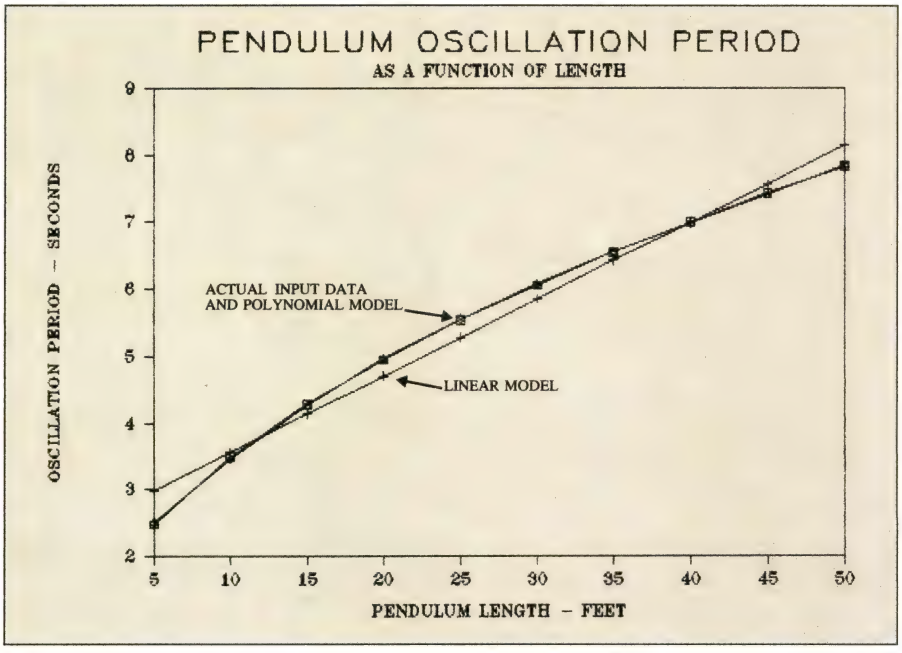



**Figure 2:** *This graph of the input data and two curve fits from Figure 1 clearly shows that the polynomial model is very close to the original input data.*

## How it works

Now that you have an idea of what *DAEPPC* does, I'll take a look at how it works. The program's main menu displays 18 available functions at start-up time (see the sidebar, "A Summary of Main-Menu Functions.") The first five functions input the data in the proper format. You specify the parameters required to plot the data using the SETUP function, and the PLOT function graphs the data on the color/graphics screen. FUNCTION specifies which math model is to be used for evaluating the data, and FIT performs the curve-fitting process. This command outputs a display comparing the original data with the results calculated by the selected math model and provides an option to send the numerical results to a printer.

The SAVE DATA and PRINT DATA functions verify that the data was entered correctly; they can also recall it for additional comparison runs. LABEL AXES (option 14 from the main menu) inputs labels for the graph axes, and LABEL GRAPH (option 15) puts titles on the graph. Comparisons with additional sets of data use the input function ENTER 2ND (option 16). The colors of the graph axes, plots, and labels can be selected with the COLORS function. The GRAPH function plots the graph using the current data and parameters as specified with the other functions.

All *DAEPPC* sessions begin with the entry of data values. After data entry, the process can take several paths. The examples in the 91-page manual carefully detail

the exact sequence of steps to be followed, depending on the desired function. Many second-level menus use function keys and the function-key labels displayed by BASIC to indicate the most logical next steps. Figure 3 shows a flowchart of normal progressions through the functions and can be used as a quick reference guide for learning the logical sequences of the many program functions.

Input values are designated as $X$ and $Y$, with individual data points specified by subscripts such as $X_1$ or $Y_1$. A prompt requests the entry of each pair of data-point values after you inform *DAEPPC* of how many points to expect. Specifying the appropriate file name recalls data saved on disk from a previous run. Up to 100 points can be entered; individual values must fall within the limit allowed in single-precision BASIC. You can select simultaneous printing of the data points as they are entered. After data input is complete, the CHECK function displays the values for verification. EDIT can then insert, delete, or correct individual data points.

R & L Software should address several limitations in its next version of DAEPPC. The EDIT prompt displays the current value, but it must still be rekeyed even if no change is desired. SAVE DATA stores the input values on disk under the specified file name, but the current version of the program does not check whether a file of the same name already exists. This means that you could wipe out the contents of one of those files fairly easily.

If all data points represent single values, as they do in the census example, or if the $X$ values are all the same, then the AVERAGE function can automatically calculate the average of the $Y$ values. The BASELINE function adds or subtracts a constant from each $Y$ value, which moves the graph up or down on the coordinate axes.

The NORMALIZE function divides all the $Y$ values of the data points by the largest $Y$ value or a user-supplied constant, which makes it easier to display data with widely ranging values. It's also useful where the main subject of an investigation is the shape of the graph rather than the data values.

Rerunning the CHECK function shows the results of the previous data adjustment actions. You can run SAVE DATA as often as desired to save the data after conversions and adjustments. EDIT is always available for correcting individual values, and PRINT DATA allows you to create a hard copy.

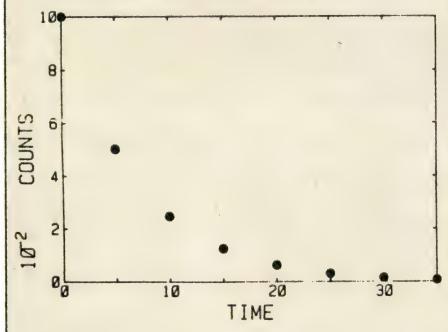
Data is saved in a sequential file in ASCII format. The first record indicates how many data points follow. Any word processor, text editor, or program editor that uses and outputs standard ASCII files

## AN EXAMPLE OF THE DATA EVALUATION SYSTEM

Analysis Of A Radioactive Decay

**STEP 1.** *Enter data, check and edit, if necessary.*

**STEP 2.** *Plot preliminary graph*




**STEP 3.** *Fit the data to the equation* $y = A_o e^{-kt}$

```
* * * * DATA EVALUATION SYSTEM * * * *

          FUNC=ORD1R

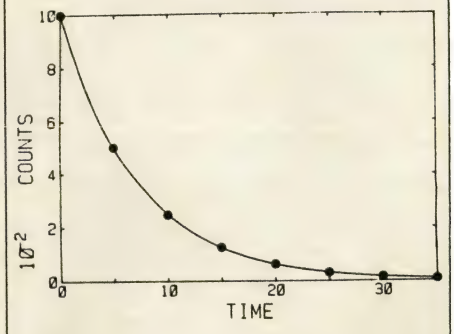
     INITIAL PARAMETER VALUES
          K =    .1000
          Ao= 1.500E 3

     FINAL PARAMETER VALUES
          K =    .1386
          Ao= 1.001E 3

 PT.    X-OBS     Y-OBS     Y-CALC    %DEV
  1   0.0000  1000.0000  1000.5642    .056
  2   5.0000   503.0000   500.4548   -.509
  3  10.0000   247.0000   250.3138   1.323
  4  15.0000   126.0000   125.2001   -.639
  5  20.0000    63.0000    62.6217   -.605
  6  25.0000    31.0000    31.3216   1.026
  7  30.0000    16.0000    15.6662  -2.131
  8  35.0000     8.0000     7.8358  -2.096

     SD(P1)=4.5985E-04
     SD(P2)=1.7142E+00
     COV(P1,P2)=+3.5284E-04
     VAR=3.1337E+00
```

**STEP 4.** *Draw theoretical curve onto the data points*




**STEP 5.** *Enter second data set.*

**STEP 6.** *Repeat STEP 3.*

**STEP 7.** *Repeat STEP 4.*

**STEP 8.** *Draw final graph.*

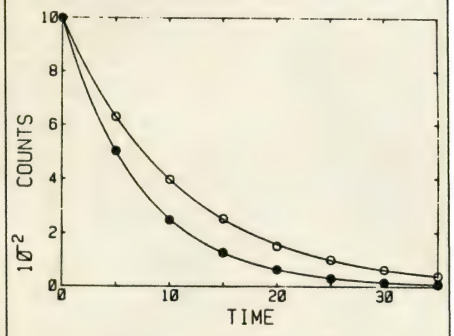



**Figure 3:** *A flowchart showing the normal sequence for using* DAEPPC.

**FUNCTIONS CURRENTLY AVAILABLE**

| Number | Name | Equation | Fit Parameters |
|---|---|---|---|
| 1 | LINE | $y=Mx+B$ | M,B |
| 2 | POLY2 | $y=Ax^2+Bx+C$ | A,B,C |
| 3 | POLY3 | $y=Ax^3+Bx^2+Cx+D$ | A,B,C,D |
| 4 | HYPBLA | $y=Mx/(x+K)$ | M,K |
| 5 | EXPB | $y=A_o\exp(-kx)+B$ | $A_o$,B |
| 6 | DEXP | $y=A_1\exp(-k_1x)+A_2\exp(-k_2x)$ | $k_1,A_1,k_2,A_2$ |
| 7 | ORD1P | $y=A_f-(A_f-A_i)\exp(-kx)$ | K,$A_i$,$A_f$ |
| 8 | ORD1R | $y=A_o\exp(-kx)$ | k,$A_o$ |
| 9 | ORD2P | $y=A_o-1/(kx+(1/A_o))$ | k,$A_o$ |
| 10 | ORD2R | $y=1/(kx+(1/A_o))$ | k,$A_o$ |

**Figure 4:** *The ten math model equations supplied with the program package.*

can revise data values once they are saved.

## Setting up the Plot

*DAEPPC* demonstrates its true power and flexibility with the SETUP and PLOT commands. SETUP automatically performs the scaling—one of the most difficult tasks of plotting. Scaling determines the value of the divisions on each axis so that all the values of the available data points will fall on the graph. Selecting the best method of scaling is frequently a matter of judgment. The most interesting portion of the data should be spread as widely as possible on the graph. *DAEPPC*'s ability to quickly display the current plot and then rerun the program with revised scaling lets you optimize the graphic presentation of the data to improve the results of the automatic scaling facility. You can use SETUP only once per run, since, to appear on the same graph, additional data sets must fit on the same axes. The program won't let you wipe out; it prohibits a second call to the SETUP function. Similarly, it gently reminds you to perform SETUP before trying to perform the initial plot.

To display a graph in color you must take a few more steps. PLOT offers more options here. First, you must decide what part of the data to plot by specifying the index of the desired starting and ending points. *DAEPPC* expects a response like 1,50, for example, which indicates that you want to plot all of a set of 50 input values. Then you must decide which of nine possible graph symbols—ranging from a line to a diamond to a filled square—you want to use.

PLOT then erases the screen and draws the graph. The axes appear first, then the scales, and finally the data points. This is your chance to watch your PC strut its stuff. Extensive calculation is required to determine the screen position of every point in a graphic line, but the process is all completed in a few seconds.

Any word processor, text editor, or program editor that uses and outputs standard ASCII files can revise data values.

If a line symbol has been selected, the graph is drawn from left to right as a continuous curve connecting the data points. A color/graphics monitor adapter board is necessary to display the graphics output. (Other portions of the program and the curve-fitting routine will run on a system with a monochrome display adapter and monitor.)

## The Plot Thickens

*DAEPPC* saves the initial display of the plot in graphics form in memory and makes available a series of new options. The F1 key is armed for returning to the main menu, from which the new options can be selected. Pressing F5 turns off the function key definitions display at the bottom of the screen so that graphs can be photographed without showing the function key labels.

The LABEL AXES function accepts alphanumeric strings that will be displayed on the plot as labels for the *X* and *Y* axes. The LABEL GRAPH function sets up a title for the entire display. The graph can be redisplayed in its current state at any time with the GRAPH function. Colors for the graph display can be chosen and modified using the COLORS function.

At this point, the main menu's mysterious ENTER 2ND function can be used to enter a second set of data for comparison with the first. Selecting this option resets the data input processor and again provides the choice of entering data from the keyboard or from a disk file. All the data manipulation functions, such as CHECK, BASELINE, EDIT, SAVE DATA, PRINT DATA, and so on, will now operate only on the second set of data values. Reselecting the PLOT function allows you to use a different symbol for graphing the new data values. This clearly distinguishes the two sets of data.

Additional data sets can be entered and graphed by again selecting the ENTER 2ND function, but be sure to save the previous set for possible later use. ENTER 2ND clears the previous numeric data from memory as soon as it is called. Once

plotted, however, each data set on the graph remains available for display with the GRAPH function until the program is terminated.

### A Fitting Conclusion

Now *DAEPPC* is ready to display its major-league muscle—the power to mathematically model the input data and compare the model results with the data both numerically and graphically. This process is invoked with a sequence of the FUNCTION, FIT, and PLOTFUNC functions.

Ten math models are available for generating the equation form that best fits the data. The modeling equations include a linear function, second- and third-order polynomials, hyperbola, single- and double-exponential decay, and first- and second-order reactions. The distribution disk includes a file for each model, and additional models are available from R&L Software.

Selecting FUNCTION presents a second-level menu for choosing the desired equation. Figure 4 shows the form and the names of the supplied modeling equations. *DAEPPC* confirms the selection by giving the name of the requested equation. FIT determines the values of the model equation constants that best represent the input data. The function uses a nonlinear, least-squares fitting procedure to determine constants that minimize the sum of the squares of the deviations between the input data values and the calculated data values. Depending on the model, it may request that the user input an initial estimate of the constants of the model equation.

The third step in Figure 3 shows the numerical results of a typical fit process including the final constant values of the model equation along with any initial estimate. The program then lists the original data, the calculated model value, and the percent deviation between the data and model values for each data point. Statistics are presented to summarize how accurately the model represents the input data.

FIT provides an option to print out the numeric results. Selecting PLOTFUNC displays the previous graph of the input data and plots the theoretical values on it for comparison. The entire process can be repeated using a different math model if it appears that another equation might generate a better fit for the data.

> The program lists the data, the model value, and the percent deviation between the data and model values.

The system's advanced features include the capability to specify individual scales and intervals on the plot axes, Poisson or proportional statistical weighting to the data points, and the use of the PLOTFUNC routine to generate initial guesses at equation constants, if required.

*DAEPPC* applies the PC's computational power to the time-consuming tasks of data analysis, reduction, and presentation. It adds accuracy to the researcher's ability to make the quick-look judgments necessary to decide how to proceed with an experimental or research effort.

*DAEPPC*'s unique combination of features, together with its plotting capabilities, enables the user to quickly and interactively determine the best mathematical model for representing a set of data. This expands the application of mathematical analysis to scientific and engineering research and development areas where, until now, only approximate methods had been practical. ■

## A Summary of Main Menu Functions

Here's a list of DAEPPC's main menu function options, complete with an explanation of what they do.

**1 ENTER DATA:** Inputs a data set from disk or keyboard.
**2 CHECK:** Displays the current data set on the screen.
**3 AVERAGE:** Averages a data set if it has multiple data at the same *X* value.
**4 BASELINE:** Adds or subtracts a constant value from each *Y* value.
**5 NORMALIZE:** Divides the *Y* values by the highest *Y* value or a user-selected constant.
**6 SETUP:** Specifies scaling parameters or auto scaling.
**7 PLOT:** Selects plot character and generates the graph on the display screen.
**8 FUNCTION:** Selects which math model equation to use for curve fit.
**9 FIT:** Performs a least-squares curve fit process.
**10 PLOTFUNC:** Plots theoretical curve, using either known parameters or the results of the curve fit.
**11 EDIT:** Revises, inserts, and/or deletes individual input data points.
**12 SAVE DATA:** Transfers the current input data to a disk file.
**13 PRINT DATA:** Prints the current input data.
**14 LABEL AXES:** Inputs strings for labeling the *X* and *Y* axes of the graph.
**15 LABEL GRAPH:** Inputs a title for the graph.
**16 ENTER 2ND:** Enters a second set of data to be compared with the first.
**17 COLORS:** Selects the colors for the graphics display.
**18 GRAPH:** Displays the current plot.

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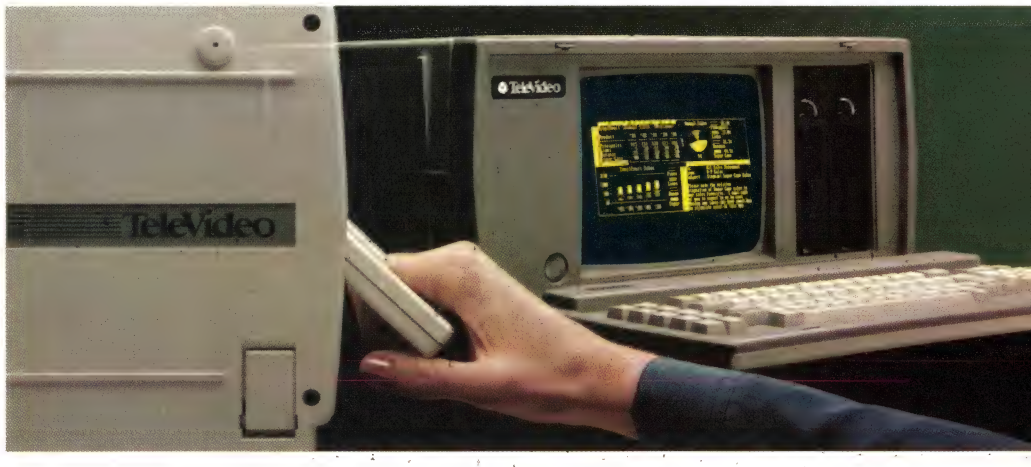
| Features | Tele-PC | IBM PC | Tele-XT | IBM XT |
|---|---|---|---|---|
| Monitor | YES | OPTIONAL | YES | OPTIONAL |
| Screen Size | 14" | 12" | 14" | 12" |
| Tilt Screen | YES | NO | YES | NO |
| Quiet Operation | YES (NO FAN) | NO | YES | NO |
| Memory | 128K | 128K OPTION | 256K | 256K OPTION |
| Graphics Display (640x200 resolution) | YES | OPTIONAL | YES | OPTIONAL |
| Printer Port | YES | OPTIONAL | YES | OPTIONAL |
| Communication Port | YES | OPTIONAL | YES | YES |
| MS™-DOS/BASIC® | YES | OPTIONAL | YES | OPTIONAL |
| System Expansion Slot | YES | YES | YES | YES |
| RGB and Video Port | YES | OPTIONAL | YES | OPTIONAL |
| **Typical System Price** | **$2995** | **$3843** | **$4995** | **$5754** |

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| Quiet Operation (No Fan) | YES | NO |
| Ergonomic Display | YES | NO |
| Communication Port | YES | OPTIONAL |
| International Power Supply | YES | NO |
| MS™-DOS 2.11 | YES | NO |
| Graphics Display | YES | YES |
| **Typical System Price** | **$2995** | **$3710** |

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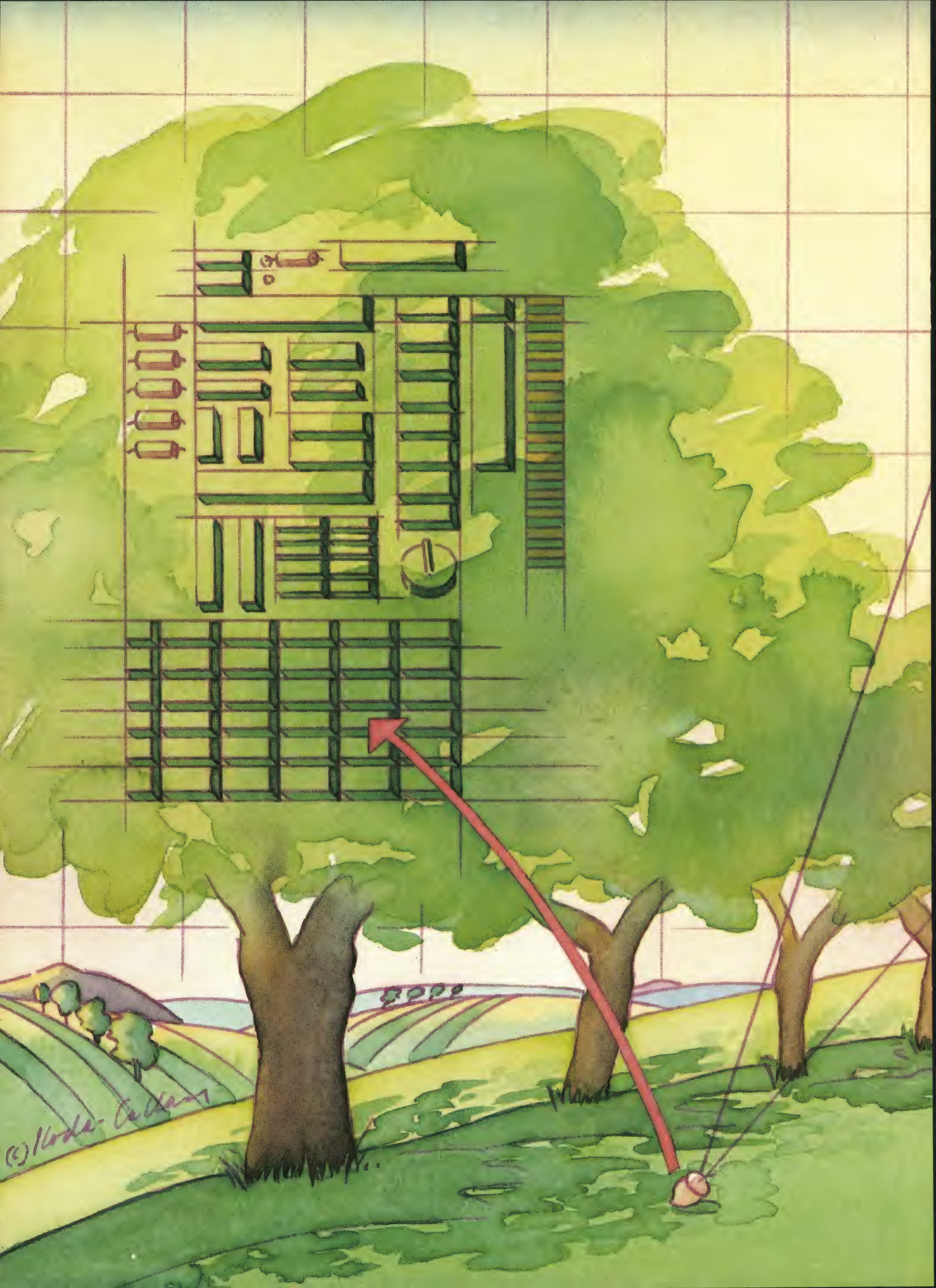
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**SOFTWARE**/BARBARA KRASNOFF

Researchers are working on a program that will let you use your PC to plan and produce your own integrated circuits.



# PPL Cultivates Circuits for Micros

There is a popular assumption that in order to plan and produce integrated circuits for microcomputers, a more sophisticated machine—a mini or a mainframe—is necessary. But researchers at the University of Utah are well on their way to generating integrated circuits for micro, mini, and even mainframe computers using nothing more than a regulation IBM PC with 256K RAM. They have devised a series of programs that use simple symbols made up of letters and other keyboard characters to represent circuit functions. This allows PC users to design, develop, and ultimately produce sophisticated integrated circuits.

Integrated circuits (IC) are a group of interconnected circuits that are usually placed on a silicon chip, making up a single electronic function. The new software, developed by Kent Smith, Brent Nelson, and Tony Carter of the University of Utah's computer science department, is called *Path Programmable Logic (PPL)*.

Illustration: Elizabeth Koda-Callan

It was drawn from an arithmetic methodology called Stored Logic Array that allows users to design circuits using symbols that represent the different functions of the IC.

Kent Smith had been in the integrated circuit industry for about 10 years when he came to the university 4 years ago. "I saw the potential of this idea and we immediately set about trying to put it into silicon," he says.

Integrated circuits are usually designed using cells, each of which represents a circuit function.

### Costly Circuits

Integrated circuits are usually designed using cells, each of which represents a different circuit function. A mainframe computer then manipulates these rectangles, polygons, and other symbols into a circuit matrix. This technique, while efficient, is also costly. According to Brent Nelson, who is working toward his Ph.D. in computer science, a Computervision drafting machine can run from a million to a million and a half dollars. Even less expensive equipment is beyond most people's range.

"There are a lot of people around, mainly hobbyists and technofiles, who know about logic, and there are companies with complete boards that they would love to turn into ICs," Nelson maintains. "But companies that specialize in custom circuits charge in the neighborhood of $50,000 for the design—and on the condition that you order maybe a billion parts from them. Using the PC, you can do a complete design yourself and have it fabricated at a silicon foundry."

Originally, *PPL* ran on the computer department's mainframe computer. "We got some IBM PCs," recalls Nelson,

## A Circuit Tour for Techies Only

### The creators of Path Programmable Logic step you through their integrated circuit program.

A block diagram of a simple circuit that we have designed using the IBM PC is shown in Figure 1. The circuit is actually a simplified version of the transmitter section of a Universal Asynchronous Receiver Transmitter (UART). The actual *PPL* program for the UART, which we created on a PC, is shown in Figure 2.

This circuit, which occupies 21 rows by 25 columns, is equivalent to an integrated circuit approximately 500 microns high and 1,200 microns wide. *PPL* can be used to design circuits with as many as 250 rows by 125 columns.

The control file in Figure 3 allows the designer to describe the external inputs and outputs to the circuit, create a file that can be used to automatically build the input and output drivers on the IC, and assign names to wires in the circuit.

The first word of each line is a keyword. If it is "name," then the remainder of the line assigns a name to a wire inside the circuit array. If not, then the line specifies the type of pad to which the signal is connected. The next two elements on the line specify the row and column position of the signal in the *PPL* array. The final item is the signal name. The information in this file is used by the first pass of the simulation program that does the DC analysis, which uses it as it creates the input file for the second pass of the simulator.

The file shown in Figure 4 is the simulation output. Although the simulator used is a special-purpose *PPL* simulator, command syntax has been borrowed from MOSSIM, a switch level simulator from MIT.

The first line defines the clocking sequence to be used. The next three lines specify groups of signals to be treated as a unit. The Watch command specifies the signals the user wants to view as the

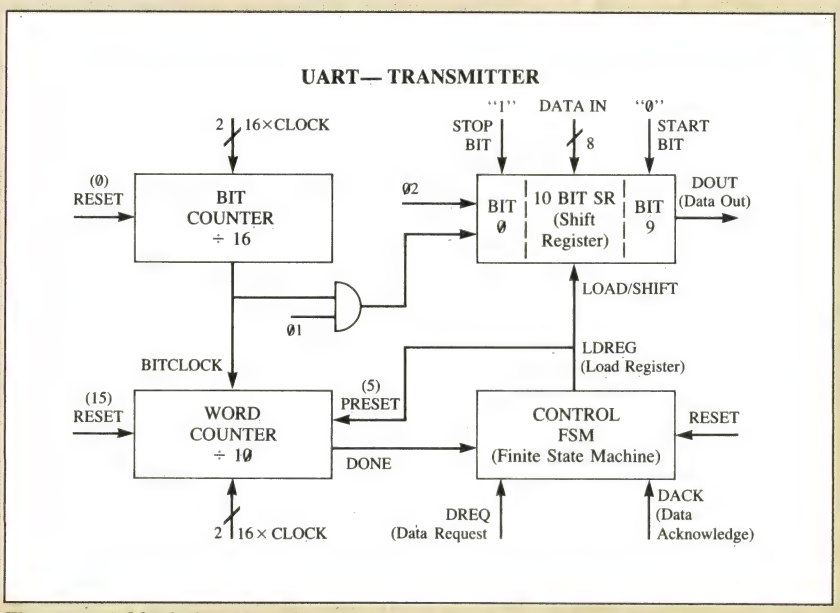



**Figure 1:** *A block diagram of a simple circuit created with the PC.*

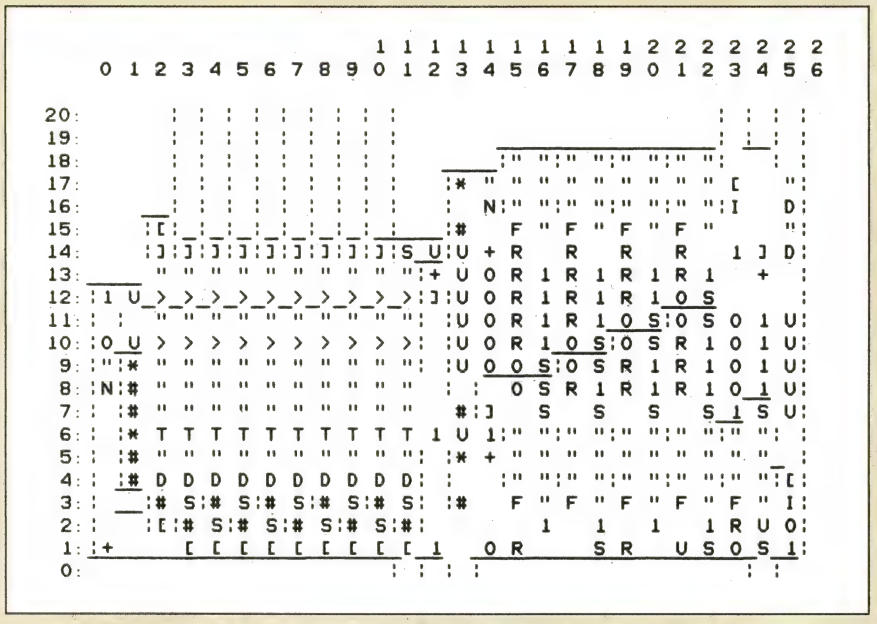


**Figure 2:** *The actual* Path Programmable Logic *program for a UART.*

```
SOURCE UART
Sourceing from: UART.SRC
-) -) CLOCK PHI1:0100 PHI2:0001
-) -) VECTOR DIN DI7 DI6 DI5 DI4 DI3 DI2 DI1 DI0
-) -) VECTOR /H BIT BIT3 BIT2 BIT1 BIT0
-) -) VECTOR /H WORD WORD3 WORD2 WORD1 WORD0
-) -) WATCH RESET DREQ DACK SM BITCLK DIN BIT WORD DOUT
-) -) SET RESET:1 DREQ:0
-) -) CY
     1:4 RESET:1 DREQ:0 DACK:1 SM:1 BITCLK:1 DIN:11111111 BIT:0 WORD:F DOUT:X
-) -) SET DIN:00110011 DREQ:1 RESET:0
-) -) CY 20
     2:4 RESET:0 DREQ:1 DACK:0 SM:0 BITCLK:1 DIN:00110011 BIT:1 WORD:F DOUT:X
     3:4 RESET:0 DREQ:1 DACK:0 SM:0 BITCLK:1 DIN:00110011 BIT:2 WORD:F DOUT:X
     4:4 RESET:0 DREQ:1 DACK:0 SM:0 BITCLK:1 DIN:00110011 BIT:3 WORD:F DOUT:X
     5:4 RESET:0 DREQ:1 DACK:0 SM:0 BITCLK:1 DIN:00110011 BIT:4 WORD:F DOUT:X
     6:4 RES  DREQ:1 DACK:0 SM:0  K:1 DIN:00110011 BIT:5 W    DOUT:X
     7:4      EQ:1 DACK:0 SM:    1 DIN:00110011 BIT:6        UT:X
              1 DACK:0 S        N:00110011 BI               X
                  ACK:0          00110011
                                 1100
  SET:0                BITCLK                 ORD:7
  .4 RESET:0 DRE          .1 BITCLK:1                WORD:8 DO
 66:4 RESET:0 DREQ:1     M:1 BITCLK:1 DI          1:1 WORD:8 DOUT:
 67:4 RESET:0 DREQ:1 DA    SM:1 BITCLK:1 DIN:      BIT:2 WORD:8 DOUT:0
 68:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00  11 BIT:3 WORD:8 DOUT:0
 69:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:4 WORD:8 DOUT:0
 70:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:5 WORD:8 DOUT:0
 71:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:6 WORD:8 DOUT:0
 72:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:7 WORD:8 DOUT:0
 73:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:8 WORD:8 DOUT:0
 74:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:9 WORD:8 DOUT:0
 75:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:A WORD:8 DOUT:0
 76:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:B WORD:8 DOUT:0
 77:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:C WORD:8 DOUT:0
 78:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:D WORD:8 DOUT:0
 79:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:E WORD:8 DOUT:0
 80:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:0 DIN:00110011 BIT:F WORD:8 DOUT:0
 81:4 RESET:0 DREQ:1 DACK:1 SM:1 BITCLK:1 DIN:00110011 BIT:0 WORD:9 DOUT:0
```

**Figure 3:** *This control file lets the circuit designer exercise control over the design.*

```
A>type uart.ctl
pro 0 13 lcol phi1;
pro 0 13 rcol phi2;
pro 20 3 lcol di7;
pro 20 4 lcol di6;
pro 20 5 lcol di5;
pro 20 6 lcol di4;
pro 20 7 lcol di3;
pro 20 8 lcol di2;
pro 20 9 lcol di1;
pro 20 10 lcol di0;
inp 20 23 rcol reset;
inp 20 25 rcol dreq;
out 0 24 rcol dack;
out 0 11 rcol dout;
name 15 15 lcol bit0;
name 15 17 lcol bit1;
name 15 19 lcol bit2;
name 15 21 lcol bit3;
name 3 15 lcol word3;
name 3 17 lcol word2;
name 3 19 lcol word1;
name 3 21 lcol word0;
name 3 23 lcol sm;
name 12 0 row load;
name 1 12 rcol bitclk;
name 10 0 row shift;
end
```

**Figure 4:** *An excerpt of output from* PPL*'s simulation programs.*

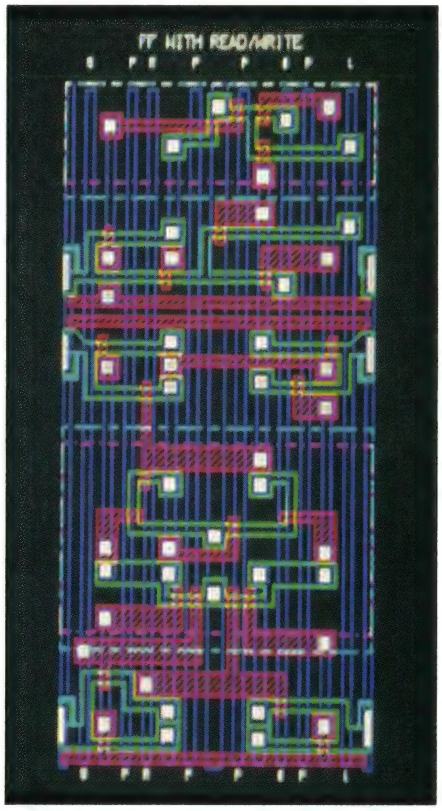
simulation proceeds. The Set command sets the values of certain inputs to the circuit. The Cycle command then causes the simulator to calculate the behavior of the circuit as a result of the input changes. The new circuit state resulting from the changes is then printed out.

Only a small part of the output is shown here; the vertical ellipses show where portions have been removed. The numbers down the left side show the clock value for the various simulation steps.—**Kent Smith and Brent Nelson**

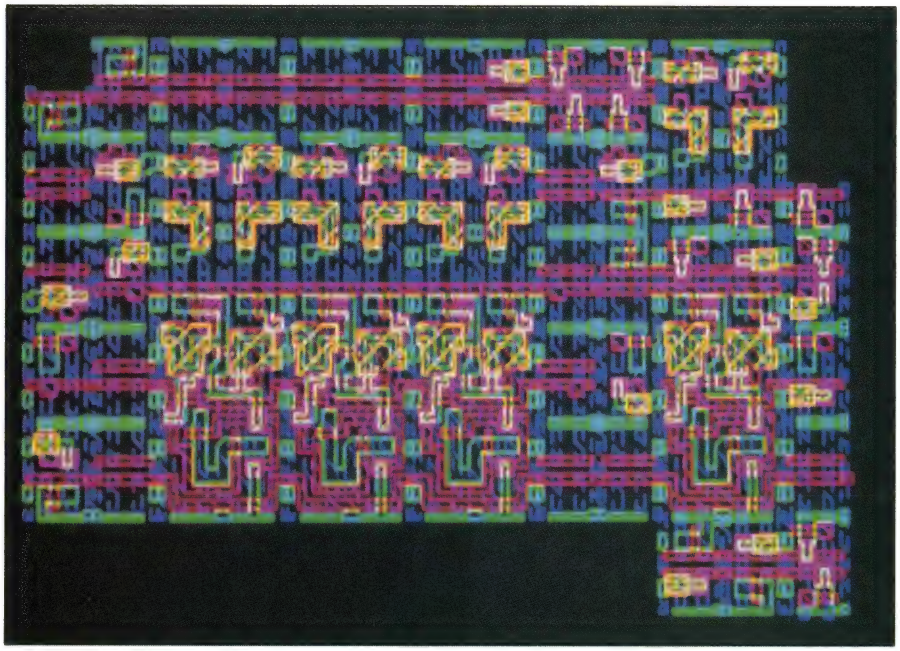
"and the heads of the department wondered if *PPL* would fit on a PC. I said 'sure,' so we did it."

The version of *PPL* created for the PC is actually made up of three separate programs. The first is a text editor called Structured Logic Editor (SLE). You enter information by typing in the proper symbols and positioning them either with the cursor control keys or a mouse. According to Nelson, the program comes up with a blank window in which you move using the editor's cursor control command. You go to the location in which you want to put the cell and type the symbol representing the cell. The program inserts it into the array on the screen and performs a placement check.

"Due to the way the circuits are implemented physically, there are restrictions about which cells can be placed next to which. For example, the program won't let you overlap cells. Certain cells have to be placed in even or odd rows or columns due to their physical implementation when they're produced in silicon. The symbols we use to represent the cells tell you the logic that the circuit is going to perform and give you the layout.




**A composite drawing of a more complex cell used in circuit designs. This is typical of the type of circuit designed using the PPL software.**



**A composite drawing of a simple latch cell, which is represented in Figure 2 as F " beneath three rows of " ".**

"The program is on-line and interactive," adds Smith. "It will tell you when you try something that's not allowed. When you hit the key to enter the symbol, if it's a legal placement the cell will simply appear on your screen in that location. If it isn't, the program will beep and print out a little message at the bottom of the screen."

After you have entered all the necessary symbols, the program will take the circuit through two simulations to check for problems that may be inherent in the circuit.

The next two parts of *PPL*, SM1 and SM2, are simulators. SM1 does a DC (electrical) check to make sure the current will get through the circuit, and a syntax check to be sure that all the connections make sense and that there are no open connections in the circuit.

SM2 takes the program through a logic simulation. You can specify what input you wish to apply to the chip, and the program will calculate the output.

*PPL* is actually a relatively uncomplicated editing program. "It will mark out a window and you can move the window around, copy it, or delete it—all the normal things you'd want to do with an editor," says Nelson. "Copying a window really means replicating a portion of the circuit; you can define little portions of the circuit and then replicate them where you need them."

## All Systems Go

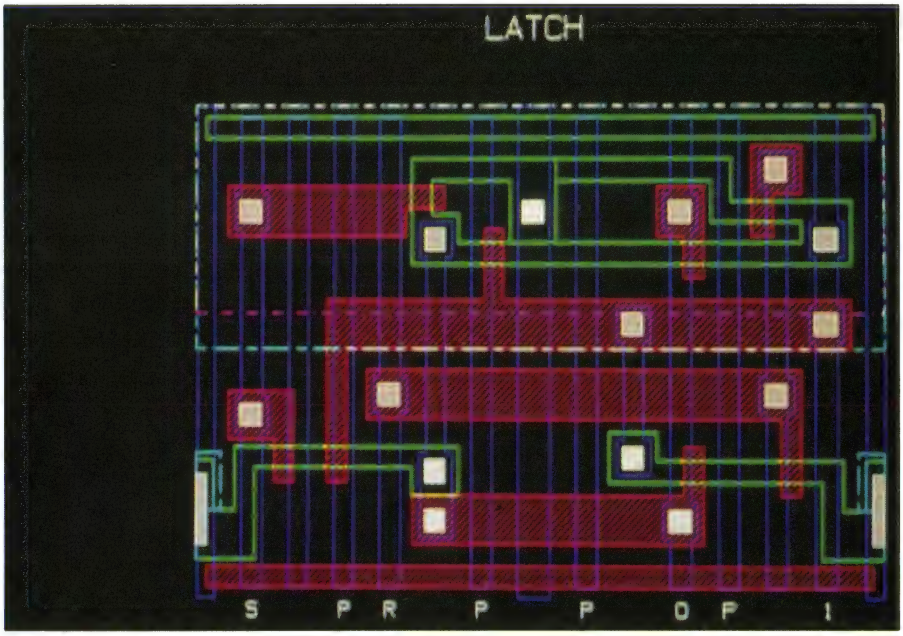
Once the circuit satisfies all the necessary requirements, it must be put into a format that can be read by the integrated circuit manufacturer. "When you're making an integrated circuit," explains Kent Smith, "you have to build layers, much like the layers of a printed circuit board on the back of your PC. In a typical process, you have to form maybe eight different layers to identify the transistors and the interconnections between them. One large drawing usually represents each layer; a different color is used for each."

To generate this composite layout, *PPL*

goes through each inserted symbol and substitutes the appropriate cell. You would send the resulting circuit to the University of Utah to be converted into the format IC manufacturers demand.

The makers of *PPL* are trying to get corporate funding in order to market their product, which is why they will not release the program necessary to convert the cells into a manufacturing format. Meanwhile, they are using *PPL* to design circuits of their own. At the moment they are using their PC to build a small microprocessor, but Kent Smith sees no reason why they should not be able to design mainframe components as well.

"I don't know that we would want to design the entire mainframe computer," he says, "although we could. We would do it in small pieces, and when we had enough pieces we would have an entire computer." ■




**A composite drawing of a group of Path Programmable Logic cells which approximate the circuit shown in Figure 2.**


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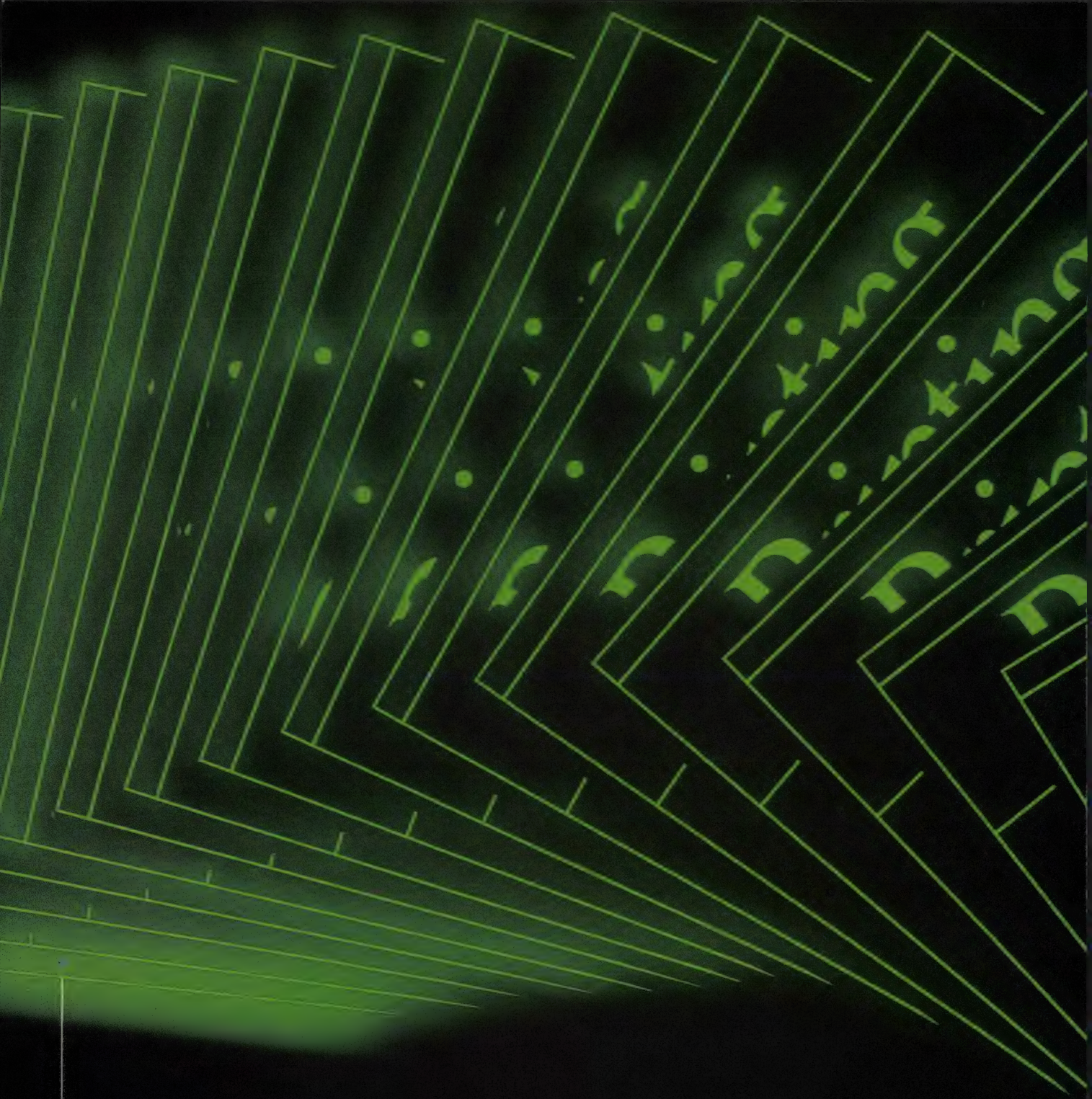
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Sophisticated graphics have come to the screens of personal computers, but PC users who want to put them down on paper are in for a disappointment. Letter quality printers simply can't handle graphics. Mechanical dot matrix printers can generate graphics and text quickly and inexpensively, but their limited resolution generates poor quality print. Ink jet printers can do the job for a reasonable price, but only at an extremely slow pace. The best way to print attractive graphics and text at a high speed may be with a laser printer.

Laser printers for mainframe computers have been on the market for several years. By writing on a photocopierlike drum with a laser beam, they can churn out text at up to 215 pages per minute; mixed text and graphics can be produced at speeds that are only somewhat slower. The bad news is their price: IBM's top-of-the-line model 3800, for example, sells for $315,000. However, prices are dropping with the development of new laser and photocopier technology. Canon, which retails a "personal copier" for $1,200, has adapted its

**HARDWARE** / JEFF HECHT

Laser printers for mainframes are nothing new, but advances in semiconductor lasers and copier technology have brought them to the threshold of the micro-computer world.

# Printing with a LASER BEAM

copier technology into the basis of an eight-page-per-minute laser printer "engine." Complete laser printers using this engine may sell for as little as $3,000.

Personal computer makers are excited by the prospect of affordable printers that can handle both graphics and text, operate at a reasonable speed, and produce clean, photocopy-quality output. Apple is already planning to offer a laser printer for its Macintosh and Lisa II systems. Industry sources say that Hewlett-Packard has similar plans and that IBM is considering laser printers for its personal computers. But whatever the label on the outside, many of the first generation of inexpensive laser printers will be made by Canon, which is concentrating on building the optics and then selling these printer engines in quantity to computer makers. These companies would then add their own electronic interfaces and software. However, industry sources say that other Japanese copier makers, including Ricoh and Minolta, are working on their own laser printers.

## How Laser Printers Work

Although laser printers are not easy to build, the basic idea behind them is simple. A laser beam is focused to a tiny spot that scans repeatedly along the length of a rotating cylindrical drum coated with a light-sensitive electrostatic material. The scanning beam is turned on and off, creating a pattern on the drum that can be transferred to paper. The process is similar to that used in a copier.

The laser "writes" dots on the drum, so, strictly speaking, a laser printer is a nonimpact dot matrix printer. However, laser printers can squeeze 180 to 480 dots into an inch, far more than the 50 to 150 dots per inch common to mechanical dot matrix printers. Higher dot density produces much more attractive graphics and much more legible text. Reading low-density dot matrix text can cause eyestrain, and many people refuse to even look at it. The output of mechanical dot matrix printers becomes more legible at higher dot densities, but the text still looks boxy, and curved or slanted lines tend to look jagged. The output quality of laser printers at 180 dots per inch is not dramatically better than that, but at 300 dots per inch the dots become practically invisible. The output looks like a clean photocopy of an original page. Higher densities look even better, and Canon claims that the model LBP-5/480 laser printer, which packs 480 dots into an inch, can generate "typesetter-quality" documents.

Higher dot densities also allow for a greater choice of typefaces. The lower the density, the more care must be taken in picking typefaces, especially italics. The jaggedness of slanted lines at low dot densities is visible and annoying. At higher dot densities, lines become much smoother and a broader selection of type styles is available.

Laser printer hardware reproduces a digital bit map, an array of dark and light spots.

Increasing dot density does tend to slow down speed, simply because the printer must produce more dots. High-speed laser printers, with powerful lasers and sensitive drums, take only a few hundredths of a microsecond to write a dot, but slower models using less expensive lasers and drums take closer to a microsecond per dot. Thus, a printer that produces 480 dots per inch would print at just over half the speed of a similar model with 300 dot-per-inch output, because the slower model must print almost twice as many dots per unit area.

The speed of an individual printer varies depending on what is being printed and how it is encoded. Laser printer hardware, like that of a video screen, reproduces a digital bit map, an array of dark and light spots. In theory, the bit map could be generated directly by the computer, but this is impractical because of the high resolution of the printed page. At the modest resolution of 240 dots per inch in both directions, an 8½-by-11-inch page contains 5.4 million bits. A 19200-baud RS-232 link would take nearly 5 minutes to transmit those bits one by one. Even a 2-megabyte-per-second Centronics 8-bit parallel interface would be a bottleneck for an eight-page-per-minute laser printer.

The solution is to encode both text and graphics for transmission to the printer, where a special interface converts the codes into a bit map without slowing down the main processor. Text is transmitted as standard ASCII characters that can be readily converted to their dot matrix representations. Graphics can be encoded using techniques such as instructions to draw a line between two specified points or to fill in a certain area with shading. Transmitting and decoding graphics generally take longer than the same operations for text, so generally the fastest rated laser printer outputs are for text only. The addition of decoding electronics and software boosts the price of a laser printer well above that of the bare laser and optical system.

## Evolution of Laser Printers

Early laser printers were expensive high-speed systems designed for the high-volume printing of material such as insurance and bank statements. Descendents of those systems remain on the market today. Although their performance has improved, they still carry 6-figure price tags. (They now generate vast quantities of personalized junk mail as well as financial statements.)

A few years after IBM, Xerox, and Siemens put out their first high-speed laser printers, other companies came out with models that were slower—although fast compared with mechanical printers. Hewlett-Packard stresses the versatility of its HP 2680 Laser Printing System, introduced in 1980, which prints 43 pages per minute at a resolution of 180 dots per inch.

It offers several typefaces, including some for foreign languages. Company logos can be put into software and called up when needed. Graphics capabilities, including the printing of bar-code symbols, are optional and limit the printer to slower speeds. The output is readable and generally attractive, although the limited resolution makes light italic type and some slanted lines appear jagged.

Newer technology, including holographic scanning optics, is used in the 28-page-per-minute Holoscan printer produced by the General Optronics Corporation, of Edison, New Jersey. The 300-dot-per-inch printer costs $12,000 and requires a $2,000 interface for character generation. Over 100 such systems have been sold, says Ray Newstead of General Optronics, mostly to defense contractors and government agencies that produce many reports. Just coming on the market is a $4,000 module that will allow the printer to produce graphics and is likely to broaden the printer's applications.

Sophisticated graphic capabilities are the main attraction of other, even slower laser printers. Quality Micro Systems, Inc., of Mobile, Alabama, offers the Lasergrafix 1200 printer that prints 12 pages per minute with 300-dot-per-inch resolution. Much of the system's cost lies in its sophisticated internal bit-mapping computer that creates graphics for plotting and computer-aided design. The results are attractive and, like the text produced by the General Optronics printer, show few traces of their dot matrix origins. Graphics are also emphasized in the LGP-1 Laser Graphics Printer from Symbolics, Inc., in Chatsworth, California. This is a desktop model that prints ten pages per minute with a horizontal resolution of 480 dots per inch and a vertical resolution of 240 dots per inch. Both the Quality Micro Systems and Symbolics printers cost $25,000.

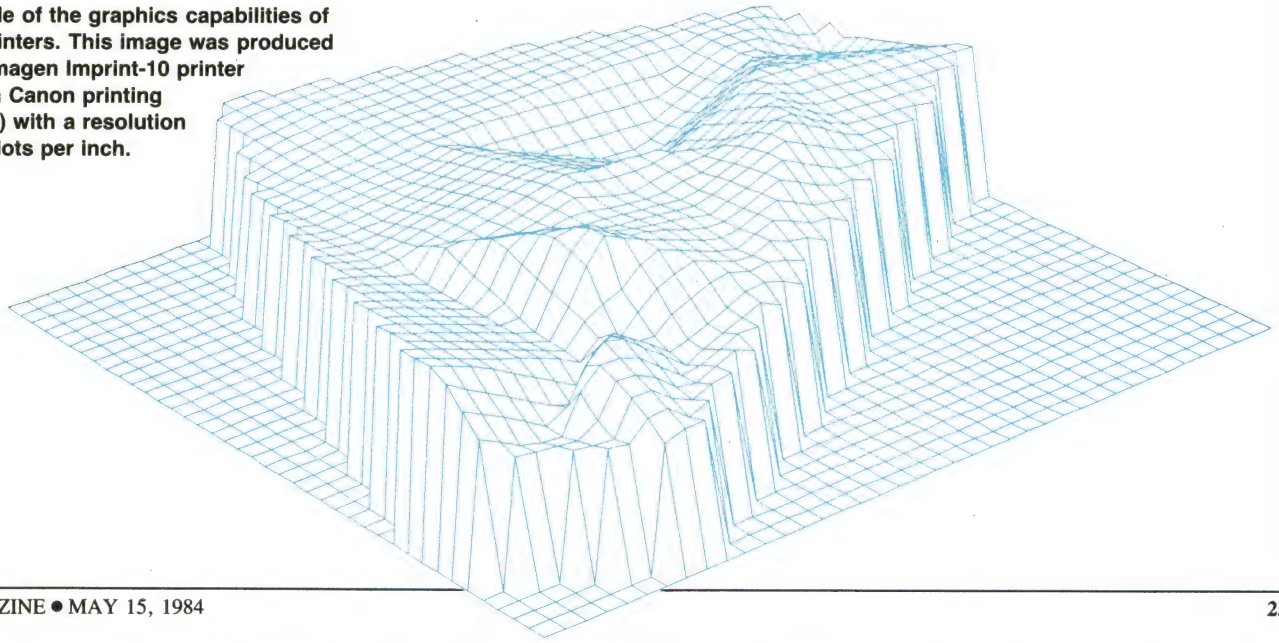
The past few years have brought great increases in the power and reliability of semiconductor lasers.

The key developments that have pushed the price of laser printers dramatically downward are births of semiconductor laser and the inexpensive photocopiers. The past few years have brought great increases in the power and reliability of semiconductor lasers. Semiconductor lasers are replacing bulky gas lasers used in earlier laser printers because, among other advantages, they can be modulated directly and do not require expensive external modulators. Meanwhile, copier performance has improved as prices have dropped, and the smelly, coated-paper copiers that were common in the days of the first laser printers have been consigned to the scrap heap.

### Canon's First Salvo

The Symbolics system mentioned above is built around a first-generation semiconductor laser from Canon. The Japanese company made the scanning and printing components and sold them in bulk to other companies that added the electronics and software needed to make them run. After selling some 10,000 such printing units, Canon announced two new models last year. One is the LBP-5/480, which prints five pages per minute at a resolution of 480 dots per inch, both horizontally and vertically. The price is $5,800 each in lots of ten or more, and, like the prices of other Canon models, that doesn't include interface software or hardware. Prices for complete versions of the LBP-5/480 with interfaces are likely to

**A sample of the graphics capabilities of laser printers. This image was produced on an Imagen Imprint-10 printer (using a Canon printing element) with a resolution of 240 dots per inch.**



run from $15,000 to $20,000.

The hottest thing on the market is Canon's other model, the LBP-CX. Its sales literature bills it as "the only laser-beam printer that fits on a desk with your personal computer." It can produce eight pages per minute with a resolution of either 240 or 300 dots per inch. Measuring a mere 18.7 by 16.3 by 11.4 inches, it weighs 54 pounds, comparable to most letter quality printers for personal computers. Like Canon's other models, it requires a serial video input, and it's marketed to companies that will buy large quantities, provide the needed interfaces, and sell complete printers to users.

The biggest news about the LBP-CX is its price. Canon isn't talking for the record, but the laser-industry trade magazine *Lasers & Applications* reports that large quantities can be bought for around $1,000 each. The need for interfaces and marketing expenses will push the end-user price up to around $3,000, or more, depending on the graphics capabilities. That's still less than 1 percent of the list price of the IBM 3800, and in the ballpark for personal computers.

The unit's low price stems largely from the use of technology developed for Canon's personal copiers, which retail for $1,200. Canon put the components that require regular maintenance—the toner, electrostatic drum, developer, and other image-transfer components—into a disposable cartridge. After about 2,000 copies, the user replaces the cartridge with a new one that retails for $65—or $3.25 a copy. This approach aims to avoid a prevalent problem with copiers: the lack of preventive maintenance. Canon also uses special optics to compensate for minor flaws in the rotating polygonal mirror that scans the laser beam across the drum—allowing the use of mass-produced scanning mirrors much cheaper than those of other laser printers.

## Who Needs Laser Printers?

At $3,000 each, these laser printers aren't the answer to everyone's printing needs. However, they do promise to solve serious problems for two growing groups of users: those who need quality printed graphics and those who need large quantities of correspondence-quality text.

The advent of windowing software is another example of the growing importance of graphics. Graphics make computers friendlier, particularly for new users and those more concerned with their jobs than with computers. For example, graphics are a major element of Apple's Macintosh. Laser printers offer a good combination of quality and speed for printing graphics.

At $3,000 each, these laser printers aren't the answer to everyone's printing needs.

Users who demand high-quality text output have long been forced to put up with letter quality printers that typically take 1 to 4 minutes to print a single-spaced page. Mechanical dot matrix printers could do the job faster, but many users refuse to send dot matrix output to valued clients or customers. The cleaner output from laser printers could satisfy many more of those users—particularly those generating reports or other long documents, who value high speed more than users who just write a few letters do.

Prices of laser printers won't keep dropping forever; too many precision optical and mechanical components are needed for prices to sink another factor of ten. Competing technologies also exist. Some observers see good prospects for thermal printers, which produce decent-quality output quickly and cheaply by heating a thin inked film to transfer an image to paper. However, the film layer brings back unpleasant memories of messy carbon-paper forms. IBM has been looking at ink jet printers, which produce good output at low cost but run slowly.

Ink jet printers do have a clear advantage in producing multicolor output, which is a weak point for laser printers. Xerox offers the model 6500 Color Graphics Printer, which is essentially a laser scanner bolted onto a color copier. However, the system's resolution is only 100 dots per inch, its speed is just 3.2 pages per minute, and its price is somewhere over $30,000. Like a color copier, it requires three passes and three separate colored toners to produce a full-color print. Even the inexpensive Canon printer can produce colors other than black if cartridges with colored toners are used, but multicolored graphics are beyond it.

The reliability of inexpensive laser printers could be a problem if, like office copiers, they are overworked and undermaintained. Ray Newstead of General Optronics recalls one potential customer who calculated laser-printer capacity by multiplying its pages per minute by 60 minutes per hour and 24 hours a day. That way he came up with a figure of a million pages a month, far beyond the 30,000 to 100,000 pages the General Optronics printer is designed to produce. Such overwork, combined with neglected maintenance, is a major reason that the sparkling-clean copies produced effortlessly in sales demonstrations are rarely matched in full-time use. Theoretically, Canon's replaceable cartridge should help cure the maintenance problem, but its ultimate test will come in the field.

Even if problems do emerge, the new generation of laser printers should find a niche in the personal computer world. Their combination of speed, graphics, versatility, and high-quality output will justify their price for many users. ■

*Jeff Hecht is a contributing editor of* Lasers and Applications, *a laser-industry trade magazine. He is the co-author of* Laser: Supertool of the 1980s. *An engineer by training, he has written for* High Technology, Omni, *and* New Scientist, *among others.*

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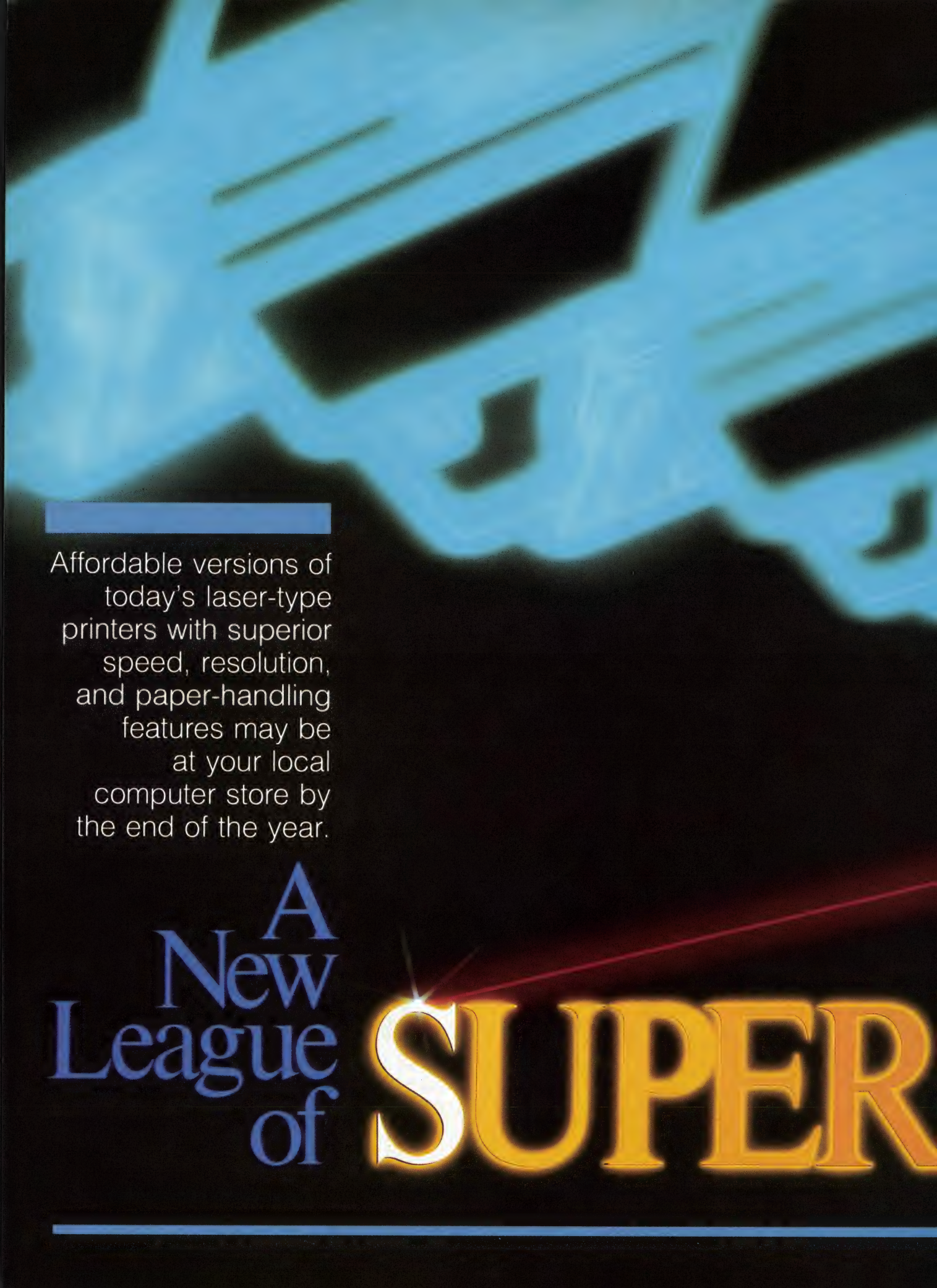
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Affordable versions of today's laser-type printers with superior speed, resolution, and paper-handling features may be at your local computer store by the end of the year.

# A New League of SUPER



# PRINTERS

**HARDWARE** / JOHN REAVES

# SUPER PRINTERS

Face it: your printer, whatever the type, model number, and sticker price, is probably the most primitive part of your whole computer system. The thing clatters and jerks and thumps, or buzzes like a dental nightmare, and the output is probably crude. If you have a lot of printing to do the beast may rock for hours, grinding away line after line.

For a long time, hard-copy output has lagged behind the advances of other PC capabilities. Memory, processing power, video graphics, and input devices have all improved in quality at a tremendous rate, and their cost has been coming down. Unfortunately, printers and other graphic output devices have evolved more slowly.

There's a good reason for the sluggish pace. Conventional impact printers require electromechanical parts to make a hard-copy impression. And it's a recognized phenomenon in recent technological history that the more electromechanical components involved in a particular technology (as opposed to purely electronic components), the more slowly the price/performance ratio improves.

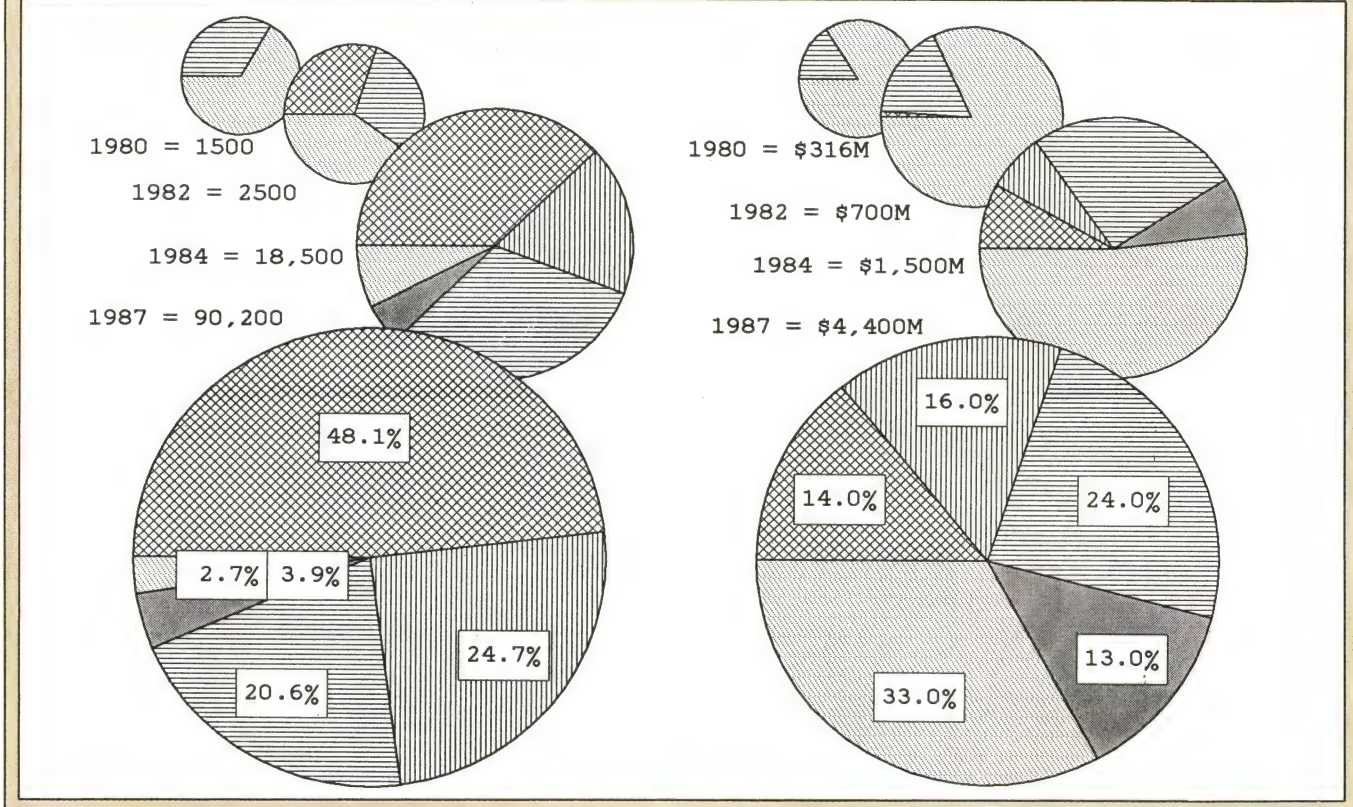
## Copier Technology

The future holds better things for printers, though, in the form of high-speed, high-resolution nonimpact printers. These "super printers" have been around since the mid-1970s but they've lurked in the wings as far as microcomputers are concerned. Because these printers use electrophotographic technology, they avoid much of the noisy mechanical nonsense of conventional impact printers, while doing a better job of paper-handling.

Most of the super printers, particularly the glamorous laser printers, are closely related to the xerographic technology commonly used in standard dry copiers. In fact, many are being built of the same components used in popular copier models, and several combine copier and printer functions. Super printers also share many basic operating characteristics with office copiers. These include high-resolution graphics capability, cut-sheet paper handling, and a relatively low noise level, plus a page-per-minute output that puts the fastest dot matrix printers to shame.

What's the catch? Primarily price. If you went out to purchase such a system today, you would find prices ranging from $14,000 for low-end systems (10 pages per minute) to a stratospheric $400,000 for the high-end systems (100 pages per minute).

But make no doubt about it: these printers represent the wave of the future. Prices are coming down; a number of Japanese companies, which are shaking up the copier market with low-cost copiers, are also




**These pie charts were produced by Canon's laser "print engine," which is now being sold to OEM's for packaging and sale. No one is saying how much the printers will ultimately cost, but rumor has it that prices will be around $3,000.**

using the same expertise to produce super printers.

In fact, Canon has publicly shown the "engine" of a low-cost laser printer using the company's personal copier cartridge technology. At a speed of 8 pages per minute, this remarkable engine cranks out text equal or superior to the best daisy wheel printers, plus graphics and halftones.

Canon is currently selling the systems without interfaces to the fabled OEMs (Original Equipment Manufacturers) for packaging and sale. Neither Canon nor the OEMs are saying how much it will ultimately cost, but the scuttlebutt is that prices will be around $3,000. And the rumor mongers also claim that the OEM-distributed offspring will be ready for sale as early as June of this year.

A number of large U.S. personal computer manufacturers have jumped on the wagon with plans to develop or market printers to run with their own machines.

## How Super Are They?

Super printers can outdo conventional impact printers in these time-saving ways.

A super printer may use one of several technologies, including laser and ion deposition. In spite of some difference in principles, their features are similar enough to be treated as a family. Many of these capabilities depend on the particular software and hardware interfaces available.

### Speed

Super printers come in a wide range of speeds, but all are fast—so fast that the conventional way of comparing speeds between printers in the PC field (characters per second) is not really applicable. Instead, super printers are usually rated in lines per minute (lpm) or pages per minute. If we assume that an average line is 60 characters long, then 10 characters per second is roughly the same as 10 lpm (ignoring differences in line-advance speeds). Super printers start at around 1,000 lpm. The real speed demons can do up to 26,000 lpm. That's dazzling compared to a top speed of approximately 50 lpm for a daisy wheel printer, or 200 lpm for a mid-range dot matrix printer.

If you are document-oriented, it might be easier to think in terms of pages per minute. The range for a super printer is between 10 and 120 full 8½-by-11 pages produced every minute. That's 10 to 120 times as fast as the fastest daisy wheel printer.

### Resolution

Many super printers can pack 90,000 pixels in a square inch, as compared to about 18,000 for a typical dot-matrix printer in graphics mode. But they do it running at full speed, whereas most dot matrix printers do their fastest work in a lower-resolution text mode. When printing graphics with a super printer, you'll notice it's superiority to a dot matrix printer in the fineness of lines, the solid blacks, the smooth edges, and the relative absence of "stair-stepping". When printing text, the super printer forms characters of dots or pixels, the same as dot-matrix printers. But the tiny size and close spacing of the dots makes the characters very close in appearance to the characters formed by a daisy wheel printer. Particularly with the higher-resolution systems, you need a jeweler's eye to tell the difference. It's not quite typeset quality, but for most purposes—including formal correspondence and even some publishing projects—the results are admirable.

### Graphics Capability

This is the payoff for a lot of applications. First, most super printers offer multiple fonts on a single page. This makes them wonderful for reports, manuals, and a wide range of other semi-fancy documents. Second, many allow you (depending on the software) to mix graphics and text on the same page, including such niceties as halftone screens and shading, and putting any character, figure, or image anywhere on the page. You can even digitize a photograph (using a video camera, digitizing interface, and appropriate software) and print it in halftones. This is great for charts, forms, reports, maps, models, logos, and other fancy graphics.

### Paper-Handling and Noise

The super printer handles paper like a copier: in cut sheets, automatically feeding paper from a cassette, on plain standard-sized paper (letter or legal). If you want a wide printout, many models will automatically turn the page image sideways for a "landscape" orientation. One of the most agreeable aspects of the technology is that there are no pounding print hammers; the noise is similar to a standard office copier.

Don't underestimate the advantages of these features. There are not many working situations where a quieter printer will fail to improve productivity and the working environment. Plus, with a conventional printer, a great deal of time may be spent on the many and varied tasks of paper-handling: feeding in paper, taking it out, separating the sheets, stacking, copying, and collating. All of these tasks are taken care of in one operation with a super printer. **—J.R.**

Hewlett-Packard already has a number of super printing systems available, and Apple is making noises about a laser printer for the new Lisa and Macintosh systems in the $5,000 range.

What all this means is that these new super printers will be price-competitive with a wide range of conventional printer types: high-end daisy wheel printers, fast multi-mode printers, line printers, high-quality plotters, and so on. Since the performance specifications of the super printers are superior to virtually any other printer type in this price range, they should demolish the competition handily.

They should start appearing on computer store shelves during 1984, looking like nothing so much as desktop copiers. They'll come supplied with personal computer interfaces and software, and they will be packaged under familiar names.

### Who Needs It?

Super printers may always be more expensive than your dot matrix or 20 CPS daisy wheel, and therefore they will hardly be worth the expense for a few letters or program listings. Where they will find their place is in the business and office automation environment, as well as in professional, engineering, scientific, publishing, and other fields that have special requirements for hard-copy output.

In all of these areas of computer-aided endeavor, the trend is toward flexible high-quality graphics and text combinations, including form and image processing, and toward networks of personal computer workstations that share peripherals, hard disks, and other systems components. These high-tech, high-volume environments will soon become the domain of super printers.

Does it make sense to have a printer that costs as much as the rest of your system? Definitely, in some cases. If your printing needs are in one of the following functional areas, you should take a serious look at this new generation of printers:

*Word processing and in-house publishing*. Super printers can intermix a variety of fonts and character sizes on one page; mix text and graphics, including charts, logos, and signatures; print on a variety of cut-sheet paper stocks, preprinted company letterheads, and transparency materials; and merge forms with variable data.

*Business graphics*. Super printers can produce high-resolution pie charts, bar charts, and line-charts and business forms with halftones, circles, two-dimensional plotting, highlighting, and condensing.

*Industrial graphics*. Super printers can generate characters with variable width, height, and orientation; print in either "landscape" or "portrait" orientation; produce compressed print, OCR characters, barcodes; and do line and box drawing, multiple forms overlay, and reverse image print.

Interfaces for word-processing applications will come first.

*Scientific, analytical, and CAD/CAM applications*. Super printers can emulate plotters, vector graphics, and other graphics devices and standards; bit-map a full page at a time; emulate vector graphics; and produce scientific notation, special characters, and high-resolution diagrams and schematics.

*High-volume line printing*. Super printers can provide high-quality data output at speeds equal to or greater than line printers on standard-size cut-sheet paper, which is easier to handle and store.

*Printing directly from a CRT screen*. Super printers can be linked to CRT terminals through an electronic interface, so a screen image can be dumped to the printer and displayed on ordinary paper.

*Electronic mail*. Link a super printer to a document scanner over a local area network or high-speed modem and you have a high-quality electronic mail system that can produce hard-copy output.

If you consider buying a laser or other super printer, be prepared to do some research and to wait for the right combination of hardware and software.

Many super printers offer an RS-232 serial interface or Centronics-compatible parallel interface, either of which is available for PCs, and some offer Qume/Diablo emulations. But it will take more than a simple hookup to fully utilize the super printer's capabilities. With only ASCII-character output, which is sufficient for any letter printer, many capabilities of a laser-type printer will go to waste. Even a simple application, such as printing a memo with multiple fonts on the same line, may be impossible with your present word processing software.

For these new printers, software is going to be as crucial as hardware. The manufacturers of printers at the lower end of the price-performance spectrum are already thinking about the problem of interfacing with micros. Interfaces for word processing applications will come first, since these are relatively simple. Next will come graphics interfaces that emulate popular graphics devices, such as the HP plotters or Tektronix displays.

What will really open the door to the brave new world is integrated packages that allow you to mix text and graphics, with the screen's display able to match everything you can print out. These functions are in the works. In fact they're available now with the Xerox Star system (for about $60,000) or with Apple's Lisa/Macintosh system, which is why a laser printer is such a natural peripheral for these systems. PC software designers won't be long in redesigning their graphics interfaces to take advantage of the new printer's high-resolution capabilities.

Laser-type printers will probably soon dominate the business and professional printer market. In their quiet way, they may be as revolutionary as personal computers were in data processing. ■

*John Reaves is a writer who specializes in plays, screenplays, and computer documentation and advertising.*

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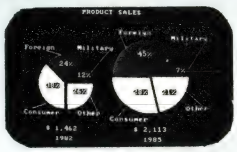
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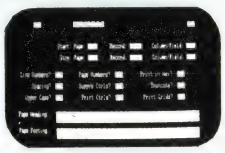
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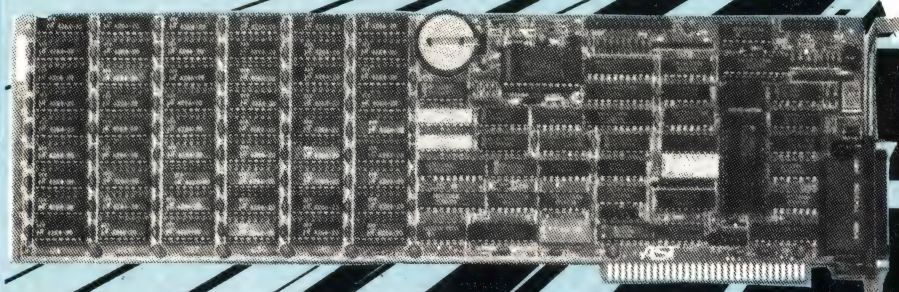
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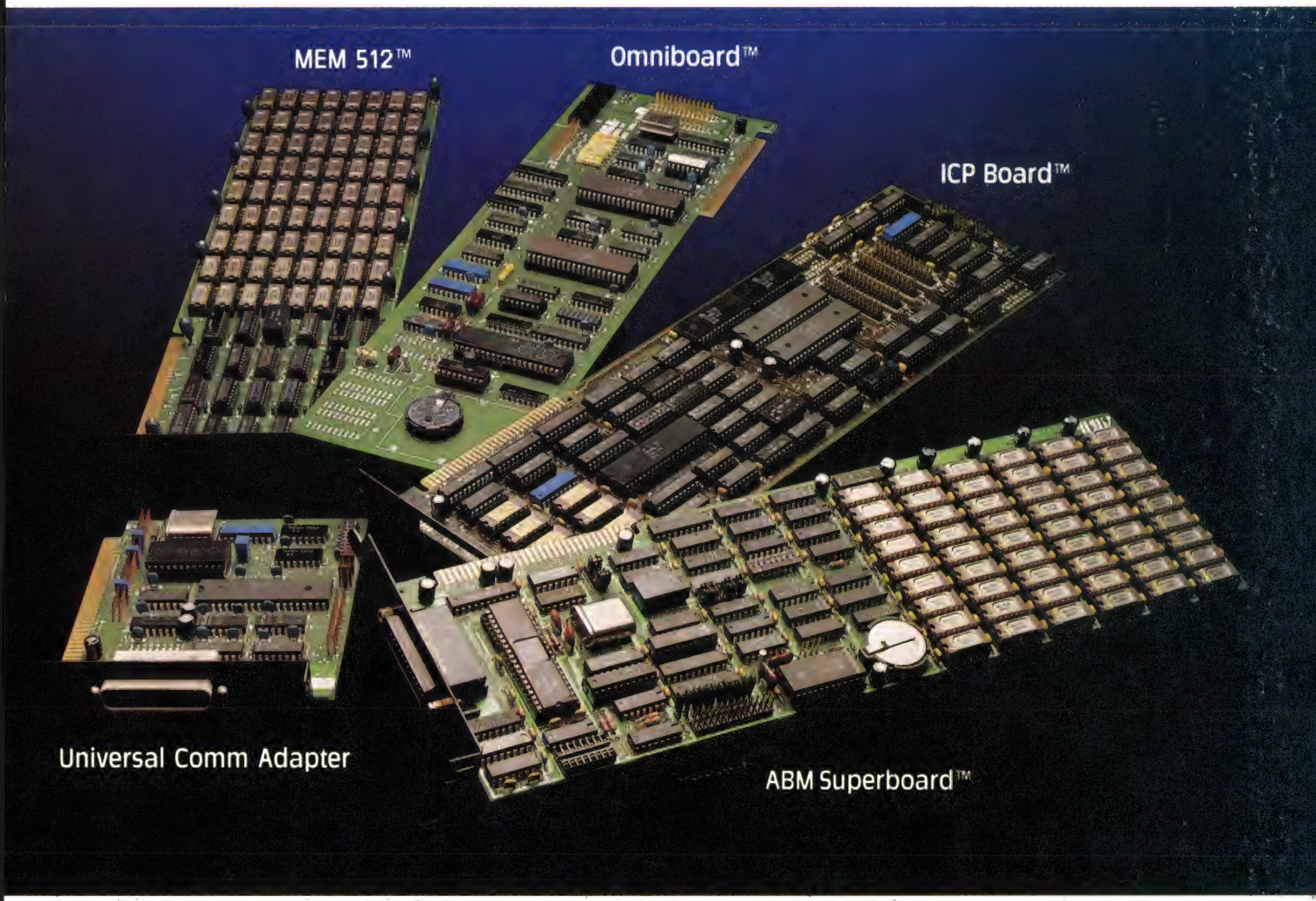
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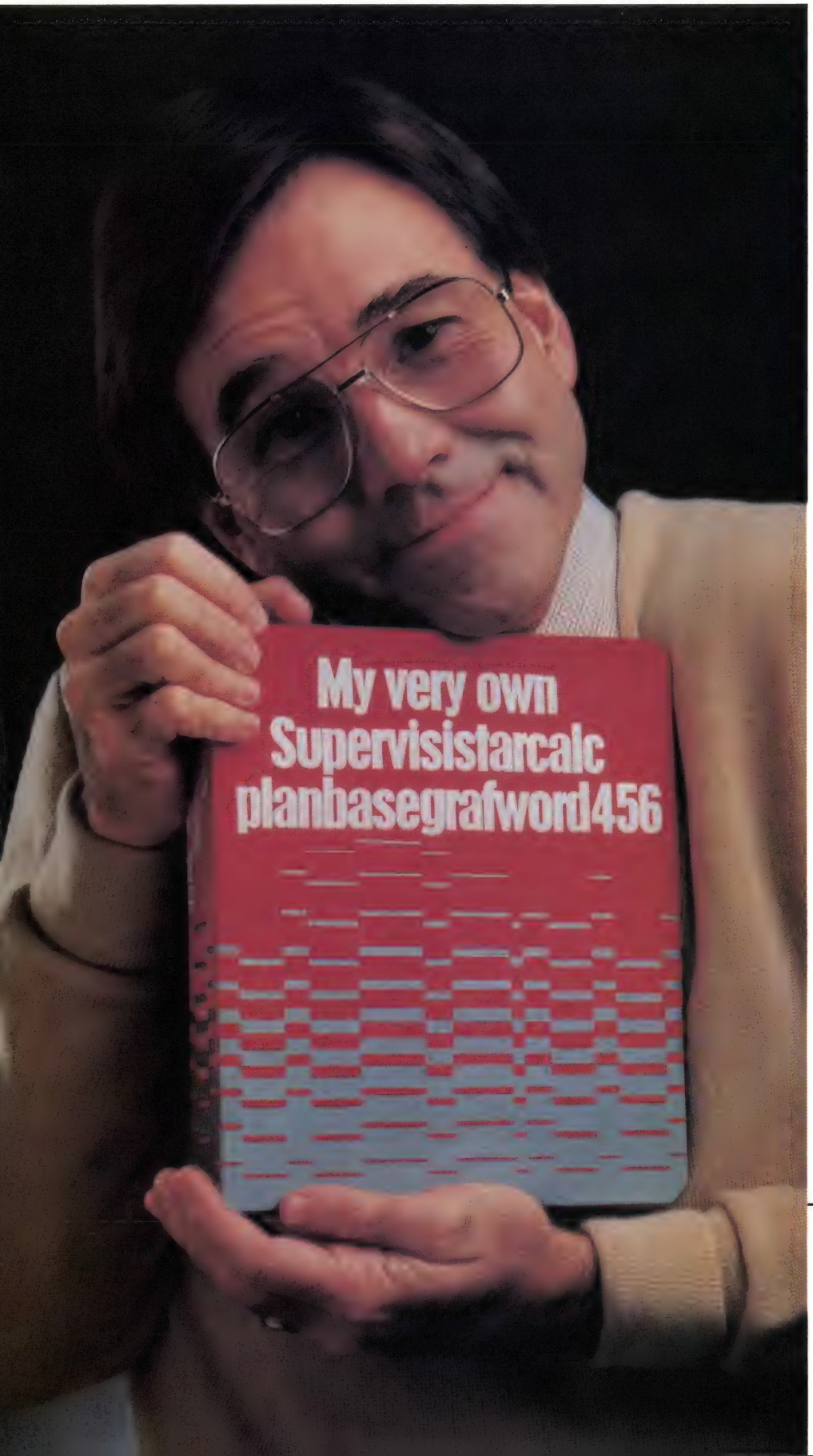
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# Building An Orderly Hard Disk

If you can envision your file system as an office building and the function keys as elevators, this guide will save you headaches when organizing a hard disk using DOS 2.0 or 2.1.

Finding files on a hard disk-based computer system can sometimes be very difficult. Have you ever tried to find your way around a strange place without directions? Locating files on a hard disk can be similarly inconvenient and frustrating.

When you've loaded many files and programs in multiple directories, locating just one of the files can become tedious. This can be an even bigger problem if someone else has loaded the data. Directories and subdirectories are supposed to help organize your files, but directory names may only give you the slightest hint as to their contents.

Menus can help organize a hard disk in the same way that the directory board in the lobby helps you find your way in a large office building. A menu of selections and directions at each directory or subdirectory level can make your hard disk easier to use by guiding you to your destination. To really beef up the system, you can assign the function keys to act like the elevators of an office building, transporting you quickly and easily from one directory level to another.

## Planning the Structure

The analogy of the office building can help you design your system. A directory level in the filing system can be seen as a separate floor in the building and each subdirectory can be seen as one of the offices. Each level will have a menu describing exactly what resides there and a main menu will be available in the root directory. The main menu will point to each of the other menus, which point to specific applications or programs. Help screens are available at each level to assist inexperienced users.

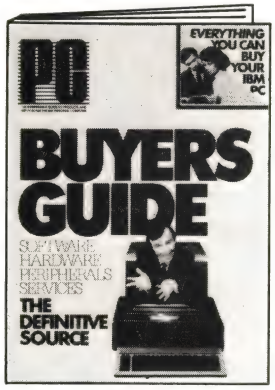
You can use DOS keyboard reassignments to assign strings to the function keys. Pressing the keys will then display menus for the current directory, the previous directory, or the root directory. The function keys can also call help screens that you design and DOS commands from any level.

In designing a menu system that is dependent on the function keys, you must come up with key assignments that are consistent at all directory levels. For instance, each level will contain a file called MENU.TXT; you can display this file by pressing a function key that issues a display command. No matter which level you are in, the menu file for that level will be displayed. Each level will also contain a help file called HELP.TXT that you can display by pressing another function key.

The function keys execute batch files that are stored in the root directory. Some of these batch files may transfer you to different levels. For instance, pressing the Main Menu function key will execute a batch file called MM.BAT that changes directories to the root level, clears the screen, and then displays the menu for the root level.

The menus help you climb through the directory levels. For instance, the main menu may contain four selections, each of which branches you into a specific type of application such as word processing, spreadsheets, games, or programming languages. After making a selection, you are transferred into a directory level containing another menu with specific selections. If the application you chose was programming languages, the selections might be BASIC, Pascal, and FOR-

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## ORDERLY HARD DISK

TRAN. If you chose word processing, they might be business documents, personal documents, and memos.

Each selection on a menu has a corresponding number that is also the name of a batch file. The batch file transfers you to the appropriate directory level and either displays a menu or starts the chosen application. Pressing the 1 key when a menu is displayed executes a batch file called 1.BAT. Each directory level that contains a menu will also contain a set of these numbered batch files corresponding to the menu selections.

All the DOS commands and some of the batch files connected to the function keys will be stored in the root directory, which is used only to hold this material. All other program files and data files will be stored in higher levels to save disk space.

A PATH command that tells the operating system to look first for a command in the current directory will be issued in the startup AUTOEXEC file. If no command is found there, the system will then look in the root directory. This gives commands and batch files in the current directory precedence over commands and batch files in the root directory.

The importance of this lies in the menu selection numbers. Each directory level will have batch files corresponding to the selections on the menu. When you press the 1 key, it is important that the batch file in the current directory is executed before the batch files in other levels.

On the other hand, a batch file connected to a function key and used to display the main menu is accessible at all directory levels, so this batch file resides only in the root directory. If you wanted to override this batch file, you would simply place a revised copy of it in the current directory.

The startup AUTOEXEC batch file also sets the system prompt. If you type

```
PROMPT $p$g
```

in the batch file, the prompt will always display the path of the current directory to help you keep track of where you are in the filing system.

### Building the System

To design a filing system to suit your own needs, you must consider the types of applications you will be running. A good place to start is with the main menu. You should organize your software into specific groups and then create a menu that lists each group. Each of the categories will branch you to another directory level and display a menu.

The following key assignments will be used to automate the filing system:

```
Alt-F1  HELP.
Alt-F2  MENU. Display Current
        Menu
Alt-F3  MAINMENU. Return user
        to root and
        display menu
Alt-F4  PREVIOUS MENU.
Display previous menu
```

The function keys are combined with the Alt key because the DOS editing functions are normally assigned to the unshifted function keys.

> Directories and subdirectories are supposed to help organize your files, but directory names may only hint at their contents.

You can create the menu with a program editor such as EDLIN or directly from the keyboard using the COPY CON command. Since the menu file will be displayed on the screen, it must be a plain ASCII text file.

Some word processors do not create these types of files. Use COPY CON to create the menu and then EDLIN to cor-




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rect or modify the file. You can create a skeleton menu that you can copy to each of the directory levels and modify to serve as the menu for that level.

After you finish the main menu, you will have to create corresponding directories for each of the selections on the menu and numbered batch files to transfer you to the appropriate selections. The root level contains the main menu, and branching from it are directories corresponding to each selection on the main menu. Each directory has its own menu with other directories branching from it.

One of the main uses for the function keys is to return you to either a menu or the root directory upon exiting from an application. For instance, if you have been using a word processor, you will still be in the word processing directory after exiting from the word processing program. Pressing Alt-F3 will immediately return you to the root level and display a familiar menu.

> You can create the menu with a program editor such as EDLIN or directly from the keyboard using the COPY CON command.

### Creating Directories

To create the four directories that correspond to the main menu selections, type in the following commands while in the root level:

| | |
|---|---|
| `MKDIR BUSINESS` | (create the business software directory) |
| `MKDIR PERSNL` | (create the personal software directory) |
| `MKDIR GAMES` | (create the games software directory) |
| `MKDIR OTHER` | (create a directory for miscellaneous software) |

The next step is to create the four batch


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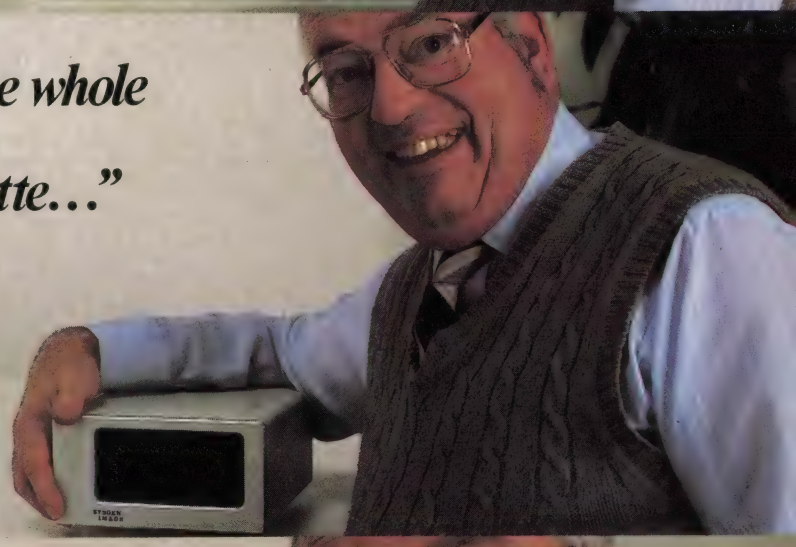
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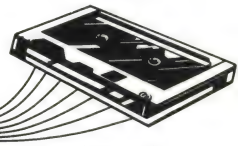
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files that transfer you to the directories, the COPY CON command is the fastest way to do this. To create the file for selection 1 of the main menu, type the following:

```
COPY CON:1.BAT
ECHO OFF              (turn display of
                       commands off)
CHDIR BUSINESS        (change directories
                       to BUSINESS)
CLS                   (clear the screen)
TYPE MENU.TXT         (display the
                       menu for this
                       level)
<F6><Return>
```

Pressing the F6 key and then the Return key writes the file to the disk. Repeat this process for each of the other files, replacing 1.BAT with 2.BAT, 3.BAT, and 4.BAT respectively and replacing BUSINESS with PERSNL, GAMES, and OTHER for each of the files. The main menu is now automated, and now you can create menus in each of the four subdirectories. Copy the skeleton menus you created earlier to each subdirectory, renaming them MENU.TXT. After the text has been added to these menus, create corresponding directories and batch files for each of the selections on these menus.

Next, you must create the key assignments that will automate the entire system. (See the sidebar "Creating Keyboard Assignments" for a special process used to assign the function keys.) The batch files for the function keys should be entered in the root directory. Type the following files:

**Tying batch files to key assignments saves room in the key assignment buffer.**

```
COPY CON: HELP.BAT
ECHO OFF              (turn display
                       of commands
                       off)
CLS                   (clear screen)
TYPE HELP.TXT         (display help
                       file)
<F6> <Return>

COPY CON:MENU.BAT
ECHO OFF
CLS
TYPE MENU.TXT
<F6> <Return>

COPY CON:MM.BAT
ECHO OFF              (change
CD\                    directory to
CLS                    root level)
TYPE MENU.TXT
                      (display main
<F6> <Return>          menu)

COPY CON:PM.BAT
ECHO OFF
CD . .
CLS                   (go back one
TYPE MENU.TXT          level)
<F6> <Return>
```

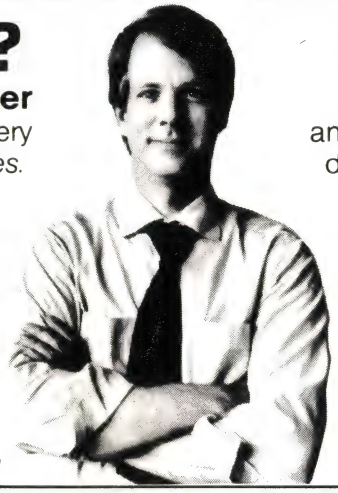
These four key assignments are just an example of what is possible. One advantage of tying batch files to key assignments is that it saves room in the key assignment buffer, which is limited to 128 characters although alterations are available to expand it. (See "How Many Angels Can Dance on a Function Key" in "User to User" *PC*, Volume 2 Number 4).

The assignments here total 31 characters, so there's still some room left in the buffer. You may want to assign certain DOS commands to the keys, such as FOR-


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MAT A:/S or DIR | SORT/+26 (sort directory by date). One of the key assignments could even display a file listing all the key assignments. If you want to assign many keys, have the keys call batch files that reside in the root directory level. These batch files would have two- or three-character file names in order to save much-needed space in the key assignment buffers.

### The Key

The key to making it all work is the AUTOEXEC.BAT file, which will set the directory path and the system prompt and assign the keys. Enter the following in the root level:

```
COPY CON:AUTOEXEC.BAT
ECHO OFF
DATE
TIME
PROMPT$p$g          (set prompt to
                     display path)
TYPE ASSIGN.CDS     (keyboard
                     assignments)
PATH \
CLS
TYPE MENU.TXT
<F6> <return>
```

To finish the system, create the rest of the menus in the applications directories. Enter the appropriate batch files and add your software applications to a specific directory.

> The AUTOEXEC.BAT file sets the directory path and the system prompt.

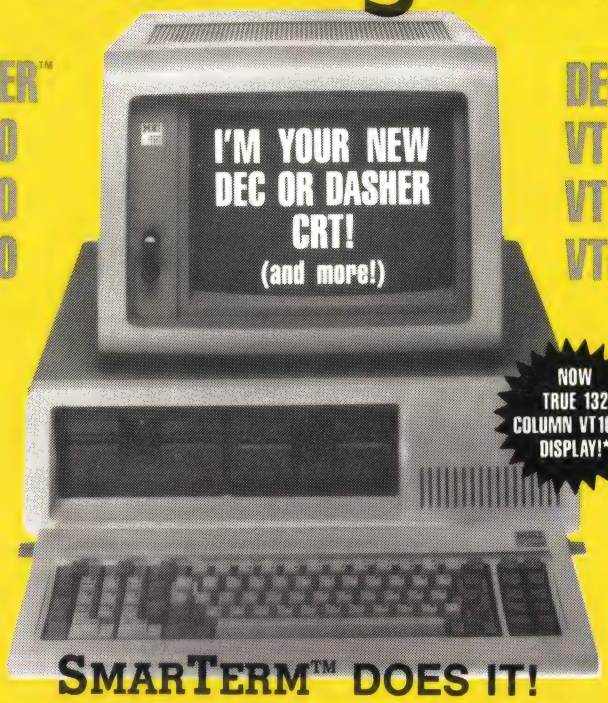
One nice thing about this file system is that it can grow outward from the main menu. You can always add a new major software group to the main menu, and if your system has two or more users you can add separate directory pathways for every user, each with its own main menu.

Another big advantage of the system is that the normal DOS prompt is always available to you if you want it. You have full control over your system as if the menus were not there, although they are always available when you need them. Just press Alt-F3. ■


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# Creating Keyboard Assignments

## You can make your life easier by assigning strings to the function keys.

Creating keyboard assignments for DOS 2.0 and 2.1 involves the following process:

1. Create a file of the control sequences for changing key assignments.
2. Create a CONFIG.SYS file containing the ANSI.SYS keyboard driver.
3. Reboot the system to load the new driver.
4. Display the assignment file on the screen to assign the keys.

The first of these steps—creating the file—is the most complex. It will be helpful for you to refer to Section 13 of the DOS manual, which describes the keyboard reassignment feature. Page 13-10 gives an example of assigning the DIR command to the F10 key with the sequence

```
ESC [0;68;''dir'';13p.
```

The 0;68 indicates the location of the F10 key on the keyboard, the 0 indicates that the key is an extended key (see page G-6 of the BASIC manual) and the 13p is a carriage return.

The tricky part is getting the escape code into the file without actually escaping while you're doing it. You can't use the escape key on the keyboard. The process described below uses a dummy character in place of the escape code, and then uses DEBUG to replace the dummy code with the escape code. After you've captured the elusive code using this method, you can use EDLIN to make multiple copies of the original line for other keyboard assignments.

Create a file called ASSIGN.CDS. The dummy character will be the asterisk. You need only the first part of the string at this point. Enter:

```
COPY CON:ASSIGN.CDS
*[0;
<F6> <Return>
```

Now use DEBUG to fix the file, and don't worry if you've never used DEBUG—this will be easy. Type:

```
DEBUG ASSIGN.CDS
```

When a dash (—), the Debug prompt, appears, type D for Dump to see a listing of the file. The first line should look something like this:

```
0952:0100 2a 5b 30 3b 00 00
00 00
00 00 00 00 00 00 00 00 *[0;
. . . . . .
```

The address is shown on the left. (My address was 0952:0100; yours may be different. This is followed by the hex numbers that represent the ASCII listing on the far right. The asterisk (which is hex code 2a) must be replaced with 1b, the escape code. Type E and the address shown on the left. In this case, you would type:

```
E0952:0100
```

You will now be able to edit the line. The asterisk character that you want to change appears first and the cursor appears next to it. Type 1b, press the Return key, type W to write the changes to disk, and then type Q to exit.

The next step is to get into EDLIN and finish the file. Type:

```
EDLIN ASSIGN.CDS
```

For 10 copies of the first line, enter:

```
1,1,2,10c
```

If you list the file at this point, you will notice that there are 11 lines of escape codes. The escape code in each line is now ^ [. At this stage you only have to add the rest of the string to each line. You can use the right arrow key to copy from the template, which is the line above the one being edited. Here's what the first four lines should look like:

```
^[[0;104;''HELP'';13p
^[[0;105;''MENU'';13p
^[[0;106;''MM'';13p
^[[0;107;''PM'';13p
```

You may use the remaining lines for your own strings. The extended codes for the function keys are listed on page G-6 of the BASIC manual. Enter 13p at the end of each string only if you want a carriage return to be executed when you press the assigned function key. When finished, hit E to exit and save the file.

The remaining steps are much simpler. Create the CONFIG.SYS file by typing the following:

```
COPY CON:CONFIG.SYS
DEVICE=ANSI.SYS
```

Then press F6 and Return. You will have to reboot to load the new driver. If you created the AUTOEXEC file shown in the main text, the ASSIGN.CDS file will be displayed on the screen and the keys will be assigned.—**T.S.**

# 1·2·3

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CIRCLE 337 ON READER SERVICE CARD

# A Trio of Mailing List Managers

Mailing list managers can perform a variety of functions ranging from printing address labels and Rolodex cards to preparing complex mail-merge data files. The program you choose will depend on your individual needs and budget. Obviously, the medium-sized company with considerable bulk mailings is looking for a different sort of program than the individual contending with the complexities of foreign address labels. The three packages reviewed here, *Mailing List I*, *PCMAIL*, and *CataList*, have strong selling points, but each was designed for different purposes.

Before sending out your next mass mailing, look at the options offered by Mailing List I, PCMAIL, and CataList. One of these programs may have you laughing all the way to the post office.

## Mailing List for Beginners

*Mailing List I*, from Alphanetics Software, in Forestville, California, comes on a single copy-protected disk and is completely menu-driven. A backup copy is available for $10. The program is easy to use. Although no manual is provided, you are told how to copy DOS COMMAND.COM and BASICA.COM onto your system disk and menu options are well explained. (If you have a question, 24-hour help is available by phone.) In fact, the more experienced user may find the menu to be too user-friendly.

The actual data entry process is quick and easy. Information can be transferred from one record to another by typing an asterisk (*) in the appropriate field. Up to 2,000 address records can be stored on one double-sided disk. Sorting takes about 3 seconds using a machine-language routine. When printing partial mailing lists, entries may be selected or excluded on any field. The new nine-character zip codes may be used. Fields are assigned for phone numbers, attention notices (for instance, ATTN: Mr. Marlowe), and special purpose one-character identification codes. The attention field can also be used alternatively as a date field or as whatever else you might need it for.

The start-up menu has six options: add new entries, change or delete entries, print labels or a master list of addresses, create a new mailing list of addresses, create a new mailing list disk file, change data files, or exit to DOS. On the screen used for entering data, the monitor displays date, time, file name, and entry record number. On the first field (called the sort field or key) you enter a person's surname or the complete name of a company, which is automatically capitalized in that field. You can edit or delete records while scanning through the entries on the sort field or record number.

*Mailing List I* will print mailing labels of selected addresses or give you a listing of all information in the mailing list file. Sorting by ascending or descending alphanumeric order is automatically done on the sort key before labels are printed. You may then re-sort the records by name, first or second address line, city, state, zip code, attention, or identification code fields. A label-screening menu lets you indicate value ranges for selection of addresses for printing based on the sort key, zip code, address, attention, and identification codes. You can also print the new entries only, choose to print from one to nine labels for each entry, or suppress the attention field altogether.

If sorting is done by zip code, *Mailing List I* will automatically print an additional label indicating the zip code and number of labels printed—a useful feature for bulk mailings.

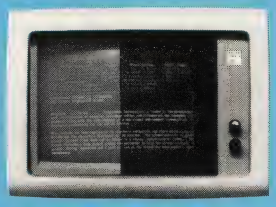
*Mailing List I* is a good program for those who want a simple, no-frills, well-organized mailing system.

## A Lot of Label

*PCMAIL*, from Richware, in Tigard, Oregon, gives you more for less, but it is slightly harder to use. The program comes on a single disk, which is not copy-protected.

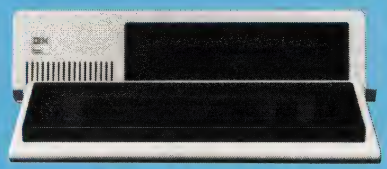
You use function keys F1 through F5 to bring up the five work screens; they look complicated, but they are easy to use. The first screen, which is for name and address maintenance, allows you to add, change, delete the record, or display the next entry. The Tab and Shift-Tab keys, which take you back and forth between the different fields of the work screen, make correc-

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tions easy. *PCMAIL* lets you store a great deal of information in each record and put most of it on a mailing label. It provides fields for two different names, three street addresses, city, state, zip code (9 digit), work and home phone numbers, and a comment line. The catch is that you must use the somewhat unconventional 1 7/16-inch by 3½-inch mailing labels. *PCMAIL* will print eight 34-character lines on each label. For some mailing list applications, like foreign mailings, institutional addresses, and special label messages, this is an important feature that is usually found only in far more expensive list manager programs.

Each mailing list has two separate disk files. The first file holds address records, the second, "name type" designations. When you enter a new record in *PCMAIL*, you select one or more of 16 name-type categories, which you define. These identify specialized mailing lists within the master file. Selection of labels for printing is based on combinations of these name-type categories.

The second work screen produces either a printed mailing list of all names and addresses or a selected listing based on one or more of the name-type categories. A third screen prints address labels of selected records. These can be printed in zip code order, and, for bulk mailings, one extra label is printed displaying the zip code and the number of labels printed. You can print from one to nine labels for each name and a text pattern ensures alignment of labels in the printer. A fourth screen lets you record or modify the name-type categories used for selecting records in print runs.

A final work screen lets you select all records that will work with *WordStar* and MicroSoft's *Word* mail-merge software.

In its next version, *PCMAIL* will support production and maintenance of Rolodex cards. *PCMAIL* updates are provided free of charge to registered owners who return the original disk. *PCMAIL* will soon be part of a package that includes software for accounts receivable and checkbook management. This program is a well-conceived, inexpensive mailing list manager that puts a great deal of information on one label. It has some minor problems; for instance, it does not give you a directory of your data files (you have to go to DOS to get the file names), but overall it's a good value for your money.

### Large-Scale Business

*CataList,* from Software Publishing and Marketing, in La Jolla, California, costs five or six times more than the previous two mailing list managers and provides a more valuable mail-management system. It is designed for large-scale business mailings and offers tremendous flexibility.

*CataList* can be used for invoicing "Ship-To/Bill-To" files and is equipped to handle foreign addresses, among other specialized mailing procedures. *CataList* will print both addresses and return addresses directly on envelopes. Labels can be printed in different type styles and Rolodex cards of various sizes may be printed in user-defined formats. Mail-merge data files produced from your mailing lists can be used with many of the most popular word processing programs. Under DOS 1.1, you get 1,734 entries per double-sided disk; with DOS 2.x you can get 1,948 entries per disk. But that's not all it can handle. *CataList* continues to work with additional data disks using the same selection criteria.

The *CataList* manual consists of more than 200 photocopied, letter-sized pages and comes in an impressive, suede-like three-ring binder. However, it serves as little more than a reference guide. Sample run-through tutorials of typical operations are sorely needed. Although working with *CataList* is not difficult, the package is complicated by dense language. For example, "Labels/envelopes or wordprocessing-interface diskette from a single master list entry? y/n" means "Do you want to print only one label?" The best way to master *CataList* is one application at a time.

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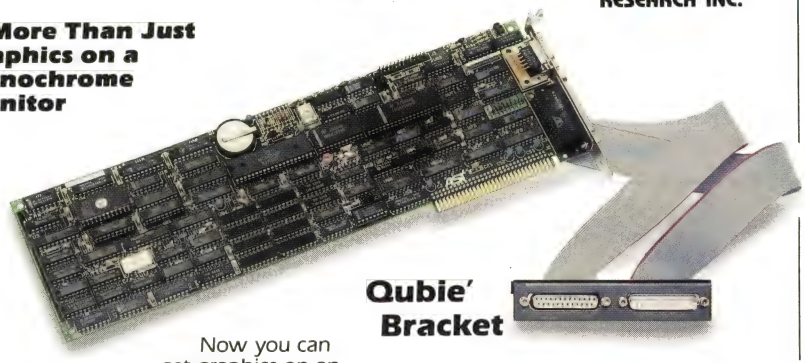
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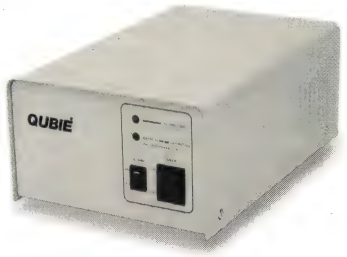
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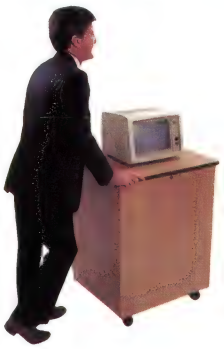
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## MAILING LISTS

Two double-sided disks are provided: 294,912 bytes in 19 files on one and 302,080 bytes in 22 files on the other. *CataList* provides many bytes for your money, but switching disks is necessary for some operations. The disks are not copy-protected, and if you have a fairly simple mailing list procedure, it may be advantageous to transfer the essential disk files to a single disk.

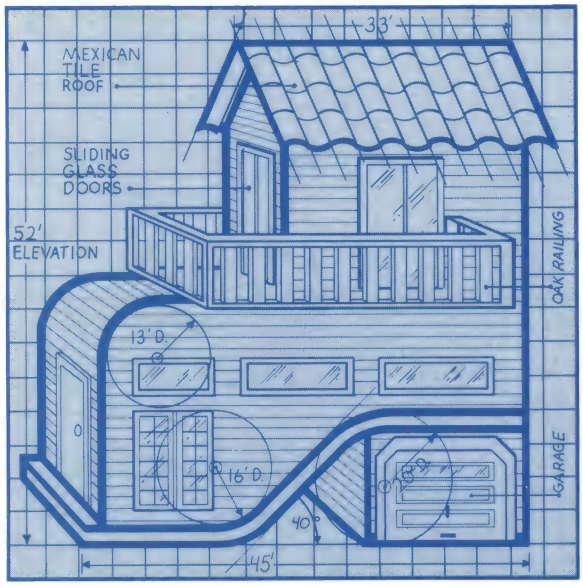
In setting up the system you select printer type (12 brands are listed or you can choose the "other" category), make a count of the entries in the master list, tell *CataList* which version of DOS you are using and whether or not you are using a hard disk. All these parameters can be saved to disk. There are 14 options of mailing list applications that may be selected from the main menu, each with a corresponding chapter in the manual. The multifarious functions of *CataList* are clearly separated in both software and manual, and beginners can learn to use the system in small chunks.

Space is formatted on the screen for entry of name, three address lines, city, state, zip code (nine characters), phone number, comment, date, category codes (three characters), addressee title code, and an account number. Data may be duplicated from record to record by entering an asterisk in the appropriate field.

The special user-defined category codes are three separate fields, each of which may contain any one of 80 alphanumeric characters. Category one, for example, could divide the mailing list into customer age groups, category two could be used for renewal notices, and category three for identifying special accounts. Mailings may be based on selection of one or a combination of up to 20 category codes in each of the three categories. These codes may also be combined in 15 different ways by the logical operators "and" and "or."

Addressee title codes allow you to decide, during any mail run, whether or not to use such titles as Mr., Ms., Dr., or Rev. with the names on the labels. The


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## MAILING LISTS

account-number field of seven digits may be used for any positive or negative numeric data, including financial information. The information in this field may be arithmetically summed in *CataList* report generation applications. Company names are sorted and retrieved on the basis of the complete name, while individuals are sorted on the basis of the surname.

An unusual feature of *CataList* is its ability to deal with foreign addresses and postal codes. One- or two-letter codes are provided in the manual for more than 90 countries. These may be entered in the "state" field on the standard data-entry screen, and the foreign postal code, whether it is numeric or alphanumeric, is entered in the zip code field. When printed, the mailing label will be automatically reformatted to reflect the postal style used by each country.

*CataList* does not provide an option for browsing through the records or retrieving them by name, partial name, or entry number. Modification and deletion of the records is possible at this time. Records can also be marked for deletion; they can be retrieved as a group and reconsidered at a later time.

For sorting and selecting records, you can choose from a variety of methods, including user-defined sort fields, zip codes, category codes, or account numbers. You then decide which of the available fields to print and in what order to print them. The mailing list records are then output to screen or printed in order of name, or of name within zip code or city, or zip code within state. User-defined sorting can be done by using up to five sort fields from 21 fixed-length, predefined fields in ascending or descending order. You can also sort by using one to five fields of variable length, each defined as "from-to" values in addition to ascending or descending order. You may define up to 50 additional selection fields for printing, each with a range of acceptable values and a designation at the time of selection as to how each may be combined with other selection fields. For each field, you may choose up to 79 characters as a criterion for entry. You can also select one of six algebraic relationships (equal, not equal, greater than, less than, greater than or equal, less than or equal) to compare the entry's field value against the constant criterion. After sorting and selection, the address records can be called up on screen or printed out in several ways: as the standard format of all 21 fields, as a telephone-type listing, as a name and address list, or on two sizes of Rolodex cards. Any subset of selected records can be stored on disk with its own index file.

*CataList* offers great flexibility in printing mailing labels. You can even print addresses directly on envelopes. Because the label-printing module is not on the same disk as the data entry module, however, switching disks is necessary. Three run-parameter selection screens allow you to choose which addresses to print, the particular format and type style of the label, and other possibilities for customization. The first screen lets you select the number of labels across the page, number of label copies to print, placement of mailing address on the envelope, the category code or upper and lower limits of zip codes or account numbers to be printed, and user-defined selection criteria. A second screen allows you to enter a "wild card" or comment line that can be added to each label as it is being printed in any one particular print run.

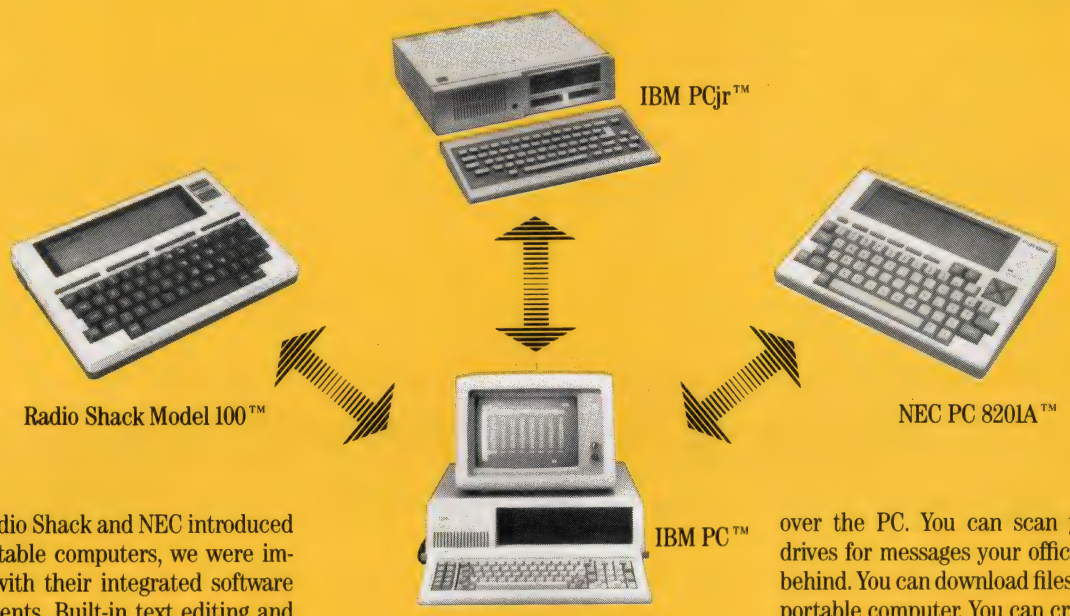
A third screen asks if you want to use the special addressee titles (Mr., Ms., Honorable) for this mailing. It allows you to define a particular printing style with Epson printers (normal, compressed, expanded, or emphasized) for each line. You can include account numbers or category codes on the labels, or, if you are printing directly on envelopes, a return address. The selections you have made on the three print run-parameter screens can be saved for subsequent mailings, or even printed out as a log.

Before printing, a final menu screen appears that allows you to alter horizontal and vertical spacing between labels and

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## MAILING LISTS

envelopes, or change the standard label line width of 31 characters to accommodate, for example, extra-wide labels with expanded characters. Labels normally include three to five lines, but an additional line can be added if necessary. If a label should require six lines, *CataList* then switches to printing eight lines per inch for that one label.

You can print two different sizes of Rolodex cards (2⅛ by 4 inches or 3 by 5 inches) using your mailing list data. These cards allow the same flexibility in sorting and record selection as the mailing labels. Address lists can also be printed using the *CataList* menu option. Other options include output to screen or printer-abbreviated address lists and display or print of the contents of the sorted-name index file.

The menu option for label printing can also be used to prepare ASCII files of selected mail list records for mail-merge programs of the following word processing systems: *WordStar, EasyWriter, WordPlus, WordPerfect, VolksWriter Deluxe, VisiWord, SuperWriter, Spellbinder, Select, PowerText, Perfect Writer, MultiMate,* and *Executive Secretary.* These files are saved to a separate, blank disk.

*CataList* is eminently appropriate for businesses that do many special mailings. It takes time to master the program's many applications, but the manual is nicely organized and fairly easy to understand, and the manufacturer provides telephone support.

Each of the three programs reviewed offers considerable value within its price range. The answer to which program is best suited to your needs, therefore, rests solely on what features you consider to be most important. *Mailing List I* offers a basic program that is exceptionally easy to operate. *PCMAIL* prints large address labels and converts your mailing list data into word processor mail-merge programs. *CataList* is designed to handle the most complex business mailings. It's your call. ■



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The medium is the message, Marshall MacLuhan once observed. Is it true that the way we present a message is as important as the message itself?

If you own or plan to buy a letter-quality printer instead of a dot matrix, you'd probably agree, although your reasoning may have been more direct: "People may have a hard time reading my reports if I get a dot matrix printer," or "I don't want anyone to know a computer wrote this."

If you want your letter-quality message to be even more eloquent, consider stepping beyond the single typeface that came with your printer. For most letter-quality printers, several dozen print wheels are available; for some, more than 100.

Carefully chosen print wheels can evoke a wide range of moods when combined with different papers, ribbons, and spacing. You can vary these factors to give your documents a subtly different look from the competition.

Too often, though, a PC owner simply sticks with one print wheel until it wears out or breaks—which usually happens when the computer stores are closed and a report is due the next morning.

But there's no reason to wait for the worst, especially when variety is so inexpensive. Most print wheels cost from $10 to $20, so a library of a dozen typefaces is available for the price

Photo: Peter Angelo Simon



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**CIRCLE 193 ON READER SERVICE CARD**

two or three boxes of floppy disks. This article contains examples of some of the most popular typefaces. The major manufacturers—NEC, Diablo, Qume, and Brother—generally have their own versions of these styles, as well as some exclusive to their brands.

Some Diablo and Qume wheels are compatible with each other and with most of the daisy wheels produced by smaller printer companies, particularly the 96-character plastic wheels arranged in word processing sequence.

Before ordering a print wheel, pay close attention to the special characters. The nonalphanumeric keys on a print wheel may be legal, math, engineering, or foreign-language symbols. The PC has no way of knowing which print wheel is on the printer, so what you see on the screen may not be what your printer types out. When you type in the shifted 6 key, the Ctrl symbol (^) on a screen, the signal your PC sends out is the equivalent of ASCII number 94 or 5E hexidecimal. The printer digests the PC's command, rotates the print wheel until it stops at the spoke (or finger or petal) assigned to ASCII character 94, whacks a tiny hammer, and, depending on the print wheel, you may see the Ctrl symbol (^), an up arrow ( ↑ ), a copyright mark (©), a capital U with an umlaut (Ü), the umlaut alone (¨), a fraction, or a right bracket (]).

In the future, you may be able to tell your computer to change its display to emulate, say, a Diablo Swedish Pica daisy wheel or a NEC Technical Math thimble. For now that would involve tinkering with the PC's inner workings, intercepting keyboard commands, or developing a custom ROM chip. Leave it to the techies.

## The Print Wheel of Fortune

Once you've decided to broaden your printer's horizons, your next step might be choosing a print wheel. While your choices are limited by the type of letter-quality printer you own, there are still a number of possibilities.

Diablo, a subsidiary of Xerox, and Qume, a subsidiary of ITT, both use standard daisy wheels (they look like the petals on a daisy that's been squashed flat) that fit each other's printers as well as a half-dozen other makes. However, the characters are not always in the same sequence, so interchange with caution. The most common configuration is 96 characters arranged one per spoke; configurations of 88, 92, and 98 characters are also available. Diablo also has a 192-character set of daisy wheels for use on a special 630 ECS (extended character set) printer that takes


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# The Care and Feeding of Print Wheels

Mishandling your print elements or cleaning them with the wrong solution may be hazardous to their health and yours.

Everyone agrees that you should keep your print wheels clean. But how? There's considerable disagreement on what products work and how safe they are for print wheels—and people.

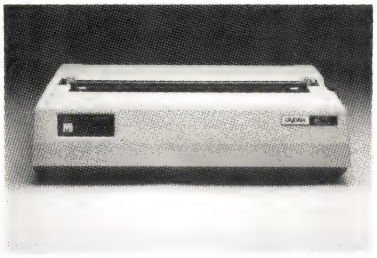
Computer supply firms charge about $20 for cleaning kits that include a cleaning solution, cleaning pads, and a holder for the print wheel. Refills cost $5 to $10. The cleaning solution may be rubbing alcohol, possibly with a fluorocarbon additive that temporarily gives the wheel a shiny or wet look.

Qume recommends either soap and water or rubbing alcohol. Diablo says no soap, water, or rubbing alcohol; that company recommends its own cleaning kit that works on all daisy, thimble, and IBM Selectric wheels. Barring that, Diablo recommends either of two readily available chemicals, methyl-ethyl-keton (MEK) or acetone. Acetone is the main ingredient in nail polish remover.

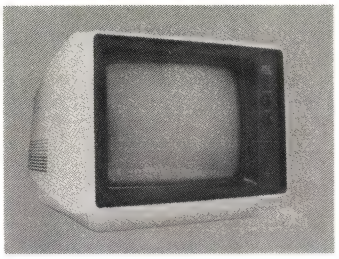
Smith-Corona recommends rubbing alcohol dabbed on the spokes only, not as an immersing bath. NEC says that soap and water, rubbing alcohol, or a household cleaner such as Fantastik are safe but marginally effective. Concentrated acetone will melt NEC thimbles, says company spokesman Joseph Tamker, while methyl-ethyl-ketone and Fedron (a platen cleaner) are safe for thimbles, but have ramifications for the user: They may cause cancer. NEC will be bringing out a thimble-cleaning kit later this year, Tamker says, that will get rid of the ink buildup without doing in the thimble or the user.—**W.K.H.**


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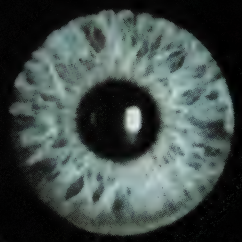
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## NEW FACE

fuller advantage of the PC's character set. Qume has a 130-character wheel for its Sprint 11/40-130 Plus printer.

The Selectric typewriter has been the standard by which letter-quality printer output is judged.

With Diablo daisy wheel elements, you have a choice between high-strength plastic and metal-covered plastic. Metal wheels theoretically have a life four to eight times that of plastic for three or four times the price, but they bend more easily and are tougher on the printer because they weigh a bit more.

Other printers that can use either Diablo or Qume wheels or their manufacturers' own include C. Itoh, TEC, some Transtar (Vivitar), and Star Micronics. These printers also emulate Diablo or Qume printer codes in case your software doesn't list their printer, and they may use Diablo, Qume, or IBM Selectric ribbons. For instance, if your word processing program doesn't list a C. Itoh F10 on the set-up chart, you can tell the PC it's a Qume Sprint 5, feed it Diablo Hitype II ribbons, and use Diablo 96-character or Qume 96 WP wheels.

NEC printers use a "thimble" printer element. Compared to the flat daisy wheels, NEC's print wheel looks like a big sewing thimble or a miniature coffee cup with the handle removed. NEC thimbles

## Proportional Magic

If you're bored with monospace but your word processing program doesn't support proportional spacing, try a bit of razzle-dazzle.

While you're waiting for the manufacturer of your favorite word processing program to upgrade it for proportional spacing, here's a trick to make your finished copy look better and read more easily.

All you need is any word processing program and a printer that can space in increments of 120ths of an inch. I'll use *WordStar* as an example, but other programs can do this, too.

Turn on justification and microjustification. Then order the character spacing 1/120 of an inch narrower than normal. For 10-pitch faces that are 12/120 of an inch wide, use .CW 11 instead of .CW 12, or the equivalent command in another program. For 12-pitch faces that are 10/120 of an inch wide, use .CW 9 instead of .CW 10. That's all. The PC and printer do the rest.

If a line with a 65-space margin breaks after 61 characters, a typical occurrence, there are four extra spaces to be accounted for, or in the case of 10-pitch (12/120 inch) type, the equivalent of 48 microspaces. The microspaces are distributed among the characters.

Result: The 11/120 of an inch specified plus the extra 1/120 of an inch microspace restores all but a handful of the characters to their proper 12/120 of an inch width. The few that remain 11/120 of an inch don't look squashed together.

As a bonus, you can use wider margins without crowding the page. At 11/120 of an inch, a 71-space margin takes up the same width as a 65-space margin at 12/120 of an inch. It's just the thing when you've got a lot to say and the boss says, "Bumstead, 5 pages *maximum* on that report!"—**W.K.H.**

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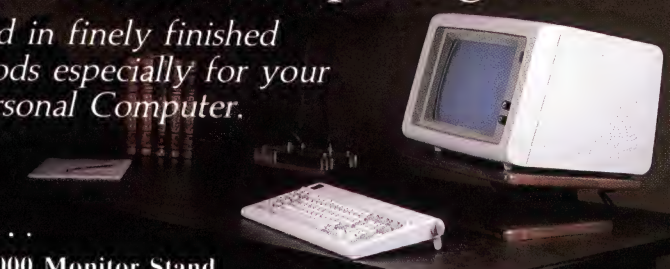
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## NEW FACE

are arranged two characters per spoke and can hold 128 characters. Only NEC printers can use these thimbles, but since NEC is the world's number one producer of letter-quality printers, finding the thimbles is no problem.

Brother manufactures a daisy wheel encased in a plastic cassette that is used by Brother, Dynax (a similar printer), Comrex (Epson), Silver-Reed, and Daisywriter. The low-cost Smith-Corona TP-1 and TP-2 daisy wheel printers employ print wheels exclusive to Smith-Corona. Juki uses Triumph/Adler 100-character typewriter wheels.

It's also possible to adapt an IBM Selectric with its interchangeable golf ball elements for use with a computer. But before you do that, ask some hard questions about the cost of conversion and the durability. Although the Selectric typewriter has been the standard by which letter-quality printer output is judged, a dedicated letter-quality printer may be a better investment even if you already own a Selectric.

### The Space Bar

Your next decision involves spacing—and you may not have realized that you had a choice. For years there was only one type of spacing: monospace, in which every character is the same width. The space allocated for the letter *i* is just as wide as the space for the letter *W*. To make everything look right, narrow letters such as *i* and *l* are artificially widened and wide letters such as *M* and *W* are narrowed.

Monospace is still the most common type of spacing available on a print wheel, and monospace wheels are available in three widths or pitches:

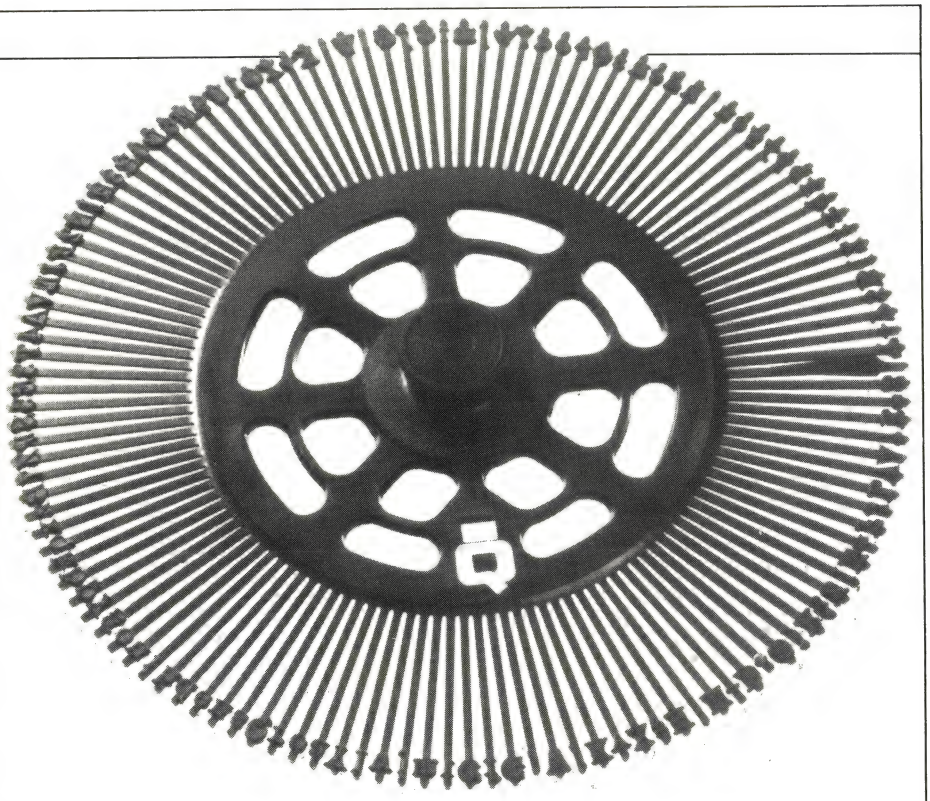
- 10 characters per inch (cpi) or 10-pitch is often called pica type after the common Pica typeface. Most letter-quality printers can space in fractions of 1/120 of an inch, so a 10-pitch character is allocated 12/120 of an inch of space. In a word processing program such as *WordStar*, that's specified as .CW (character width) 12. On a standard sheet of 8½ × 11 typing paper

with 1-inch left and right margins, a 6½-inch-wide typing area has 65 characters. The "pica" in pica-size print wheels shouldn't be confused with the pica measurement used by magazines and newspapers, which is ⅙ of an inch. Ten-pitch is the most common width, probably because it's the largest and therefore the easiest to read.

With microjustification, the PC directs the printer to insert slivers of space 1/120 of an inch wide randomly between characters.

- 12 cpi or 12-pitch, generally called elite type, is slightly smaller than pica type. Each character is 10/120 of an inch wide. In *WordStar,* 12 cpi is specified as .CW 10. (More than a few *WordStar* users find it confusing to specify .CW 10 for 12-pitch type and .CW 12 for 10-pitch type.) A 6½-inch typed line has room for 78 elite characters.
- 15 characters per inch is useful when you really need to stuff a great deal of information into a limited amount of space. Each 15-pitch character is 8/120 of an inch wide. A 6½-inch typed line can hold 97 15-pitch characters. Printers must be set for 15-pitch type through software commands (.CW 8 in *WordStar*) if their front-panel switches are limited to 10-pitch and 12-pitch. These software commands are sometimes called printer setup commands.

With a letter-quality printer, character height is not generally considered. Most print wheels have characters 8 to 10 points high (a point is 1/72 of an inch), and each single-spaced line is 12 points or ⅙ of an inch, including the space between lines.



**The Qume 130-character daisy wheel, available in a variety of typefaces.**

## PS—Truer Spacing

The alternative to monospacing is the proportional space (PS) wheel. The characters on proportional space wheels are truer to the way we handwrite or typeset, taking into account the widths of individual characters. Figure 1 illustrates how proportionally spaced letters take up different amounts of room. A typeset capital *W* or *M* may be three or four times as wide as a lowercase *i*. With PS print wheels the range is narrower, more like two to one. A line of proportionally spaced characters takes up about as much space as the same line in 12-pitch type.

Crown
Caslon
Times Roman

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

MMMMM mmmmm
IIIII iiiii

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

MMMMM mmmmm
IIIII iiiii

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

MMMMM mmmmm
IIIII iiiii

**Figure 1:** *Proportional spacing is true to the way characters are handwritten or typeset. Wide letters naturally take up more space than narrow ones.*

To use a PS print wheel properly, you need a printer that supports incremental spacing, invariably in 120ths of an inch, and that accepts PS wheels. You'll also need a word processing program that supports proportional spacing. The current version of *WordStar,* for instance, won't space proportionally, but *PeachText, The Final Word,* and MicroSoft *Word* will.

If the software doesn't support proportional spacing, the PS print wheel will still print, but it won't look quite right. The text will come out monospaced—every character will be either 10/120 or 12/120 of an inch apart depending on the pitch selected. At 10-pitch, spaces between lowercase letters will be noticeable, while at 12-pitch the capitals will be jammed together. (If you get apparently random characters, you forgot to flip the printer's selector switch

from monospace to proportional space. PS wheels are arranged in a different order than monospace wheels.)

Don't confuse proportional spacing with microjustification or justification. To justify text, the PC inserts spaces between words until the right margin lines up. If a line of 62 characters must be fit into a 65-space margin, the PC picks three words and inserts an extra space after each.

With microjustification, sometimes called microspacing, the PC directs the printer to insert slivers of space 1/120 of an inch wide randomly between characters. If justification and microjustification are used jointly, enough microspaces are added to align the right margin.

Both justification and microjustification have drawbacks. With justification, the gaps between words are evident and it's obvious from the result that a computer did it, especially if you use narrow margins or automatic word wrap. With microjustification, the page looks good at a glance but the extra fractions of space between characters slow the reader down. The reader may not know what's wrong but will have trouble reading the copy quickly. Justified type is easier to read than microjustified type.

```
Courier typeface
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890     !@#$%^&*()_+

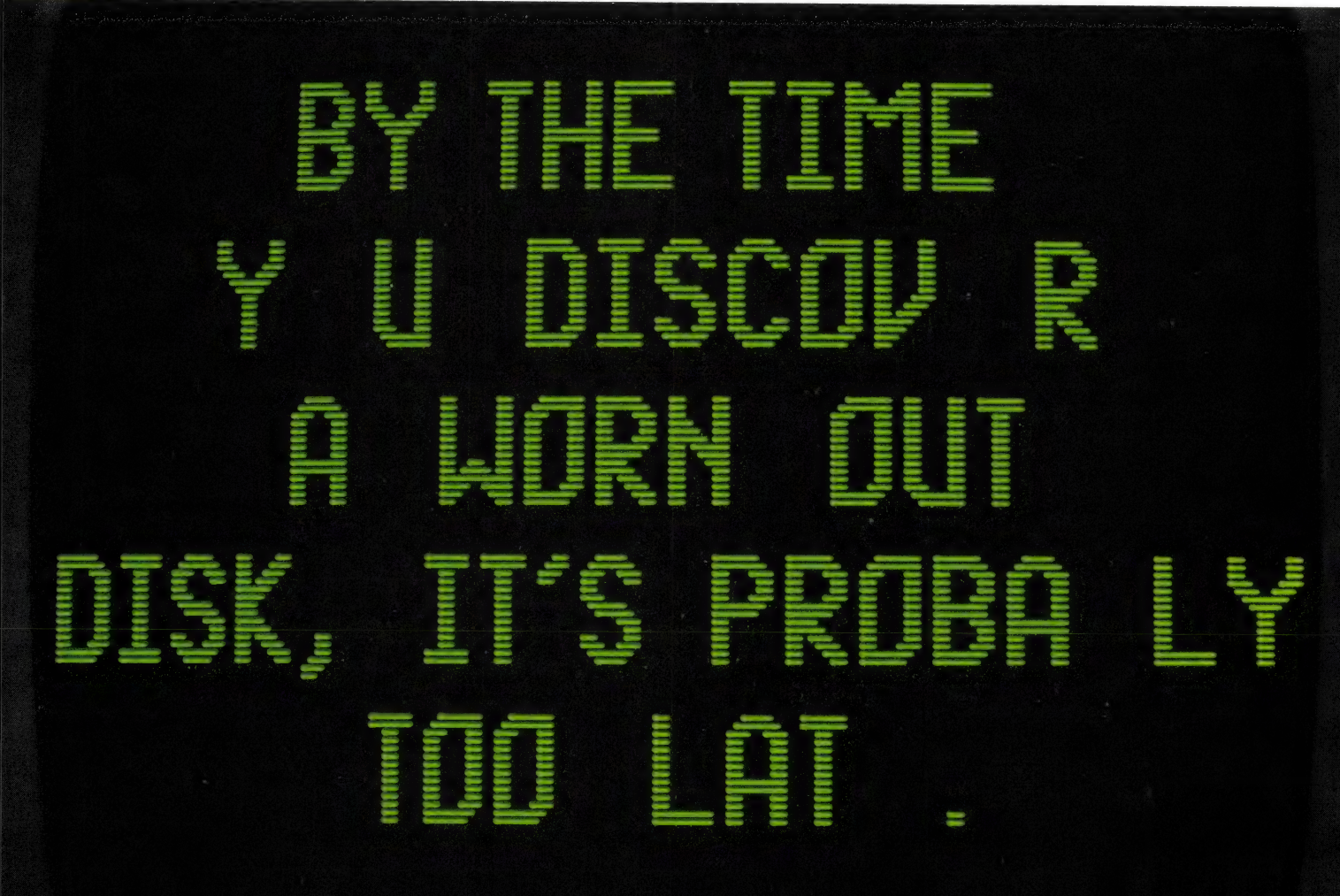
Pica typeface
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890     !@#$%^&*()_+
```

**Figure 2:** *Examples of two of the most common print wheel typefaces, Pica and Courier. There are many more styles to choose from.*

Proportional spacing takes advantage of the printer's microspacing capabilities but uses them purposefully, not randomly as a monospace wheel does. The software has a built-in lookup table that allocates those 120ths of an inch according to how wide each character needs to be. Proportionally spaced material can be either justified (even right margins) or ragged (uneven right margins).

## Type Style

Now you get to make your most creative decision—the typeface itself. See Figure 2 for examples of some of the most popular faces, Courier and Pica. To many people, Courier type is reminiscent of an IBM Selectric, while Pica type may seem



more like an old Underwood or Remington manual typewriter. Note especially the differences in the lowercase *g* and *y*. The two faces are similar in that they are both serif type styles in 10-pitch. It's easier to get a feeling for a print wheel by looking at a text example than by examining a chart of characters, and you'll probably want to see a wide range of typefaces before you make a choice.

What else should you look for? On some print wheels, the zero may be slashed. The apostrophe or single close quote may be at a 45-degree angle to distinguish it from the single open quote mark. The crossbar of the *e* may be tipped at an odd angle; the *s* may be an avant garde squiggle. On some print wheels, the lowercase letters may actually be small capitals.

In addition to style differences among the alphabet and numbers, there may be completely different punctuation and special characters on a print wheel. Look for differences in the shifted top row, which on a PC monitor is:

! @ # $ % ^ & * ( ) − +

In addition, substitutions are often made for the braces or brackets ([ ]), curly brackets ({ }), single open quote (‘), tilde (~), backslash (\), vertical bar (|), and left and right arrows (< >), since these characters don't get much of a workout in word processing applications. For instance, some legal fonts assign the fractions ½ and ¼ to the left and right arrows.

### Check with ASCII

For a better idea of the character set, take a look at ASCII listings for these characters to compare what the PC outputs to the screen to what a particular print wheel produces on paper. Diablo and Qume have excellent typeface listings that include ASCII charts arranged from low to high along with text examples. NEC has concentrated until recently on building ultra-reliable printers and rudimentary typecharts, but the company promises to produce better thimble comparison charts (still no ASCII charts).

Finally, look for a print wheel that goes beyond the standard 94 characters (the PC has 47 alphabet, number, and punctuation keys and 47 more shifted characters). You can access the additional characters through the Alt key or with a special software command ordering the printer to "shift out" to the extended characters. The extra characters generally will include a set of capital letters in a contrasting typeface; fractions, half-size superscript num-


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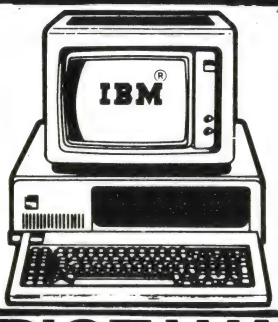



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bers, and miscellaneous business symbols; or special graphics characters.

An extended character set gives a printer real flexibility, but the number of keystrokes you need to access them can be annoying. If you work with many special characters, a keyboard enhancer such as RoseSoft's *ProKey* is a godsend. For instance, the *WordStar* command to access the fraction 5/8 on a NEC printer with a Super Courier thimble is Ctrl-P, Ctrl-Q *J*, Ctrl-P, Ctrl-W. Those nine keystrokes could be shortened to two, possibly Alt-J, with a keyboard enhancer that memorizes the special key sequence and assigns it to one key.

Even if your print wheel has more than 94 characters, you may not always be able to access them. For instance, NEC's top-of-the-line 7710, which uses a serial interface, can readily produce only 94 of the 128 thimble characters when hooked to a PC. If you're still shopping, you'll find that some manufacturers offer three variations on the same printer: serial interface, parallel interface, and PC-specific parallel interface. The PC parallel interface may cost $200-$400 more (as in the case of NEC's Spinwriters), but the difference pays for special ROM chips that, when they work correctly, make the NEC think it's really a letter-quality version of IBM's dot matrix printer. Qume deserves special mention for its sensible and sensibly priced solution: a single printer with $95 plug-in interface boards for specific computers or interfaces, including the PC.

Once you decide on a printer and a group of print wheels, take good care of the print elements. Print wheels respond well to being started, spun, stopped, and hit with a hammer 10 to 55 times per second, yet they're susceptible to heat, dust, bending, and being dropped on the floor. Daisy wheel or thimble wallets that hold four to eight print wheels are your first line of defense. They cost $5 to $10 each. Because disasters are still possible, keep backups on hand at least for your main, workhorse print wheel. Try to use the print wheels for printing only, not as coasters for coffee and tea cups.

### Fabric or Film

It's best to keep separate sets of print wheels for fabric ribbons and for film ribbons. Fabric ribbons leave ink residues that fill in and blur the enclosed characters, and some of the sharpness of a film ribbon is lost when the ribbon is used with a wheel full of fabric ribbon crud. Regular cleaning helps restore sharpness, although the makers can't agree on what chemicals clean and what don't (see sidebar).

After each character strike on a multistrike ribbon, the film advances a fraction of the character width.

Ribbons come in three types: fabric, multistrike film, and single-strike carbon. Fabric, the familiar typewriter ribbon, comes in black, red and black, or shades of brown or blue. Fabric lacks the clear detail of a film ribbon but is cheaper and doesn't run out abruptly the way a film ribbon does. Fabric ribbons have definite shelf lives; after a year on the shelf they may lose some of their boldness. Try to buy them from a dealer who has rapid turnover. Store an opened ribbon in a sealed plastic bag if you won't be using it for a week or so. If the ribbon develops a dry spot, spray the spot with just a trace of WD-40, the spray lubricant. It works like a charm. Don't overspray—one squirt is good, but two are not better.

After each character strike on a multistrike ribbon, the film advances a fraction of the character width. Because of the film's spongelike ability to absorb material from adjacent unstruck areas, you get several characters out of each character width of film. Multistrike ribbons are not profoundly affected by sitting on the shelf

before use. They are available in colors, usually brown or blue, that work well with lightly tinted stationery.

If you want the highest quality, price no object, buy a single-strike carbon ribbon that advances one character width for each character struck. The impression is slightly darker and sharper than the multi-strike ribbon. It's a good choice for documents that will be photocopied or printed. Not every manufacturer offers single-strike ribbons.

A fabric ribbon is good for 700,000 to 2½ million impressions, say the manufacturers. A multistrike ribbon lasts 180,000 to 400,000 characters, depending on the brand and amount of film. A single-strike ribbon may only last 35,000 characters. As a rule of thumb, figure 60 to 65 double-spaced pages per 100,000 characters.

To save a few dollars, it's possible to buy off-brand ribbons. Quality can vary considerably; be sure that when you order a brand-name ribbon you don't get sold off-brand merchandise. Third parties also make "compatible" print wheels that may or may not equal the quality of the factory original.

Re-inkers for fabric ribbons are available for $30 to $60. They work, but you have to factor in the initial purchase price and the time spent using the re-inker.

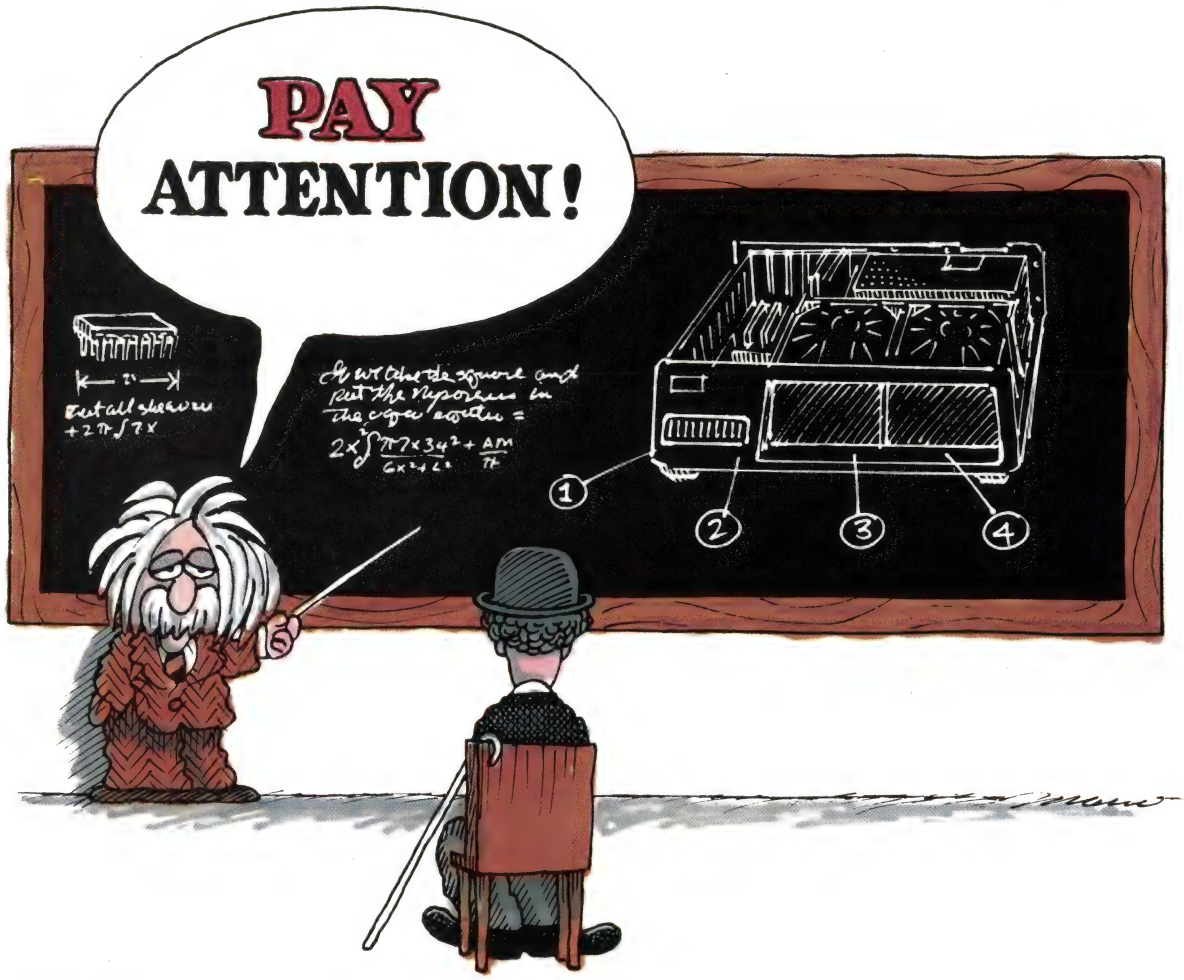
### A Working Library

Here are some good choices to begin your library of typefaces: Courier and Pica, both 10-pitch; one of the Elite faces, 12-pitch; a proportional space wheel such as Bold PS; a 15-pitch wheel to tame wide spreadsheets; a big 10-pitch face for speeches, such as Orator, Focus, or Letter Gothic; an italic face, possibly matched to one of the other faces; a Prestige face such as Prestige Pica or Prestige Elite for bolder print; and a sans serif (no curlicues) face such as Gothic.

Add one or two print wheels that appeal to you, some lightly tinted stationery, and brown or blue ribbons in addition to basic black, and let your letter-quality printer show off its versatility. ■



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| Inventory Control & Analysis, Order Entry, Accounts Receivable | $899 |

**CONTINENTAL**

| | |
|---|---|
| Home Accountant | $109 |
| First Class Mail | $89 |
| Property Management | $349 |
| Tax Advantage | $39 |

**SUNDEX**

| | |
|---|---|
| Certified Personal Accountant | $119 |
| Certified Personal Investors | $119 |

**SELECT**

| | |
|---|---|
| (Specify DOS) | |
| Select Write & Teach | $89 |
| Select Word Processor (includes Teach, SuperSpell, Merge, Print) | $269 |

**INTESOFT**

The Next Generation!

| | |
|---|---|
| InteCalc (3-D spreadsheet) | $269 |
| InteWord (25 more features than Wordstar) | $369 |
| IntePert (Critical Path) | $179 |
| IntePlan (Time Management) | $129 |
| ALL OF ABOVE JUST | $799 |

**XQ SOFTWARE**

| | |
|---|---|
| Tax Strategist | $289 |
| Investment Strategist | $289 |

**LINK SYSTEMS** — But for You!

| | |
|---|---|
| DATAFAX | $199 |

**INSOFT**

| | |
|---|---|
| DATA DESIGN | $179 |
| GRAFORTH | $59 |
| TRANSFORTH | $99 |

**XOR SOFTWARE**

| | |
|---|---|
| C TOOLS UTILITY | $79 |
| THOTH DATABASE | $79 |
| BLUE CHIP PORTFOLIO | $66 |

**MAXELL DISKS**

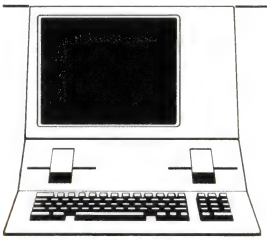
| | |
|---|---|
| MD1 Single Sided Double Density | $27 |
| MD2 Double Sided Double Density | $40 |

**NEW!**

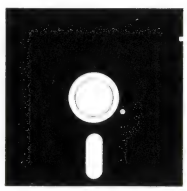
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|---|---|
| BLUE SKY SILICON OFFICE | $789 |

## LEISURE SOFTWARE

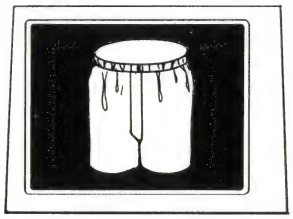
| | |
|---|---|
| Sega Star Trek | $33 |
| Sega Zaxxon | $33 |
| Hesware MinnFats Pool | $25 |
| Hesware Gridrunner | $25 |
| Avalon Diplomacy | $45 |
| Avalon T.A.C. | $33 |
| Spinnaker Facemaker | $23 |
| Spinnaker Delta Drawing | $37 |
| Spinnaker Fraction Fever | $23 |
| Spinnaker Hey Diddle Diddle | $21 |
| Spinnaker Most Amazing Thing | $27 |
| Spinnaker Rhymes & Riddles | $21 |
| Spinnaker Story Machine | $23 |
| Spinnaker Snooper Troop I | $30 |
| Spinnaker Snooper Troop II | $30 |
| Epyx Temple of Apshai | $27 |
| Epyx Upper Reaches Apshai | $16 |
| Epyx Curse of Ra | $16 |



HARDWARE



SOFTWARE



UNDERWARE

## PERIPHERALS

### MONITORS

**But for You!**

| | |
|---|---|
| BMC 13" Composite Color Plus | $229 |
| BMC 12" Low Res Green | $85 |
| BMC 12" Hi Res Green | $119 |
| BMC 12" Hi Res Amber | $129 |
| USI 12" Green Hi-Hi Res | $129 |
| USI 12" Amber Hi-Hi Res | $139 |
| TAXAN 12" Green | $99 |
| TAXAN 12" Amber | $109 |
| TAXAN 13" RGB Color | $499 |
| NEC JC 1216 RGB | $419 |
| NEC JB 1205 Amber | $155 |

### MODEMS

**NOVATION**

| | |
|---|---|
| PC CAT, Crosstalk (1200) (baud) | $415 |
| Smart Cat 103-212 1200 | $415 |
| 212 Auto Cat | $575 |

**ANCHOR MODEMS**

| | |
|---|---|
| (with power & cable) | |
| Mark 12 300-1200 baud | $319 |
| Volksmodem 300 baud | $79 |

### PRINTERS

**STAR MICRONICS**

FREE Freight & 6 Month Added Warranty

| | |
|---|---|
| GEMINI 10X Dot 120CPS | $287 |
| GEMINI 15X Dot 120CPS | $497 |
| DELTA 10X Dot 160CPS | $597 |
| DELTA 15X Dot 160CPS | $747 |
| POWER T DAISY 18CPS | $497 |
| RADIX 10 Dot 200/50CPS | $847 |
| RADIX 15 Dot 200/50CPS | $997 |

### DISK DRIVES

**CONCORDE DISK DRIVES**

| | |
|---|---|
| IBM Sgl. Sided Sgl. Density | $289 |
| IBM Dbl. Sided Dbl. Density | $399 |

**GRAPHICS TABLET**

| | |
|---|---|
| CHALKBOARD POWERPAD (with IBM Start Kit) | $149 |
| Software Packages: | |
| Leonardo Logo | $39 |
| Leo's Links | $27 |
| Programmer's Kit | $19 |
| BearJam | $25 |
| KOALAPAD | $109 |

**KENSINGTON MICROWARE**

| | |
|---|---|
| PC SAVER | $39 |
| MICROSAVER | $59 |
| BOTH ABOVE | $89 |

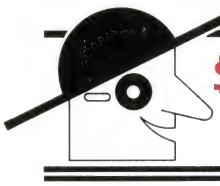
### BOARDS

**AST**

| | |
|---|---|
| ComboPlus, 64K S/P/C | $273 |
| ComboPlus, 256K, S/P/C | $469 |
| MegaPlus II, 64K, 2-S/P/C | $339 |
| MegaPlus II, 256K, 2-S/P/C | $489 |
| 256K MegaPlus II Expander | $289 |
| SixPakPlus, 64K, S/P/C | $289 |
| SixPakPlus, 256K, S/P/C | $489 |
| SixPakPlus, 384K, S/P/C | $589 |
| I/O Plus II, 2S/P/C/G | $189 |
| PCnet™ LAN Kit | $1284 |

**PLANTRONICS**

| | |
|---|---|
| ColorPlus, 16 color brd. w/Para Port | $369 |



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# Automated Letters: Fill-in-the-Blanks

A new species of word processing programs promises to take the drudgery out of writing business letters. Be careful, though. There's no telling where this sort of thing may lead.

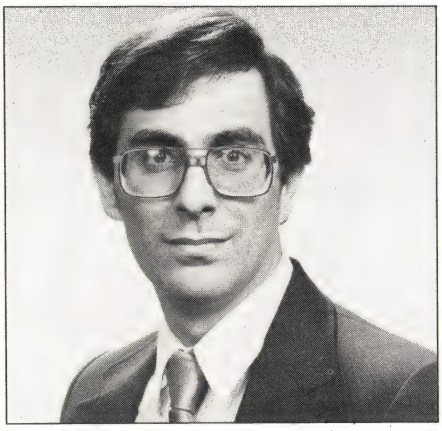
Yes, I know that being a writer may not appear to be the toughest of jobs. It's inside work, there's no heavy lifting involved, and you get paid for sticking your nose into other peoples' business.

But really, folks, it's a difficult way to earn a living. Toting those verbs and shifting those personal pronouns can get to be pretty wearing. You've got to be creative and precise, and you've got to be fast. And the biggest problem is that once you've finally come up with a really nice piece of writing, you can't just keep on using it again and again, like a microprocessor chip assembly line once the design is done. No, you've got to file those perfectly balanced words, those hand-chosen verbs, and those highly polished modifiers into the scrapbook (an uncomfortably apt phrase).

So, it was with a mixture of anger, bemusement, envy, and fear that I found myself reading advertisements for a new species of "automatic letterwriting" word processors that have begun to sidle into the PC market. These packages present a "fill-in-the-blanks" approach to letter writing, guaranteed to make you, CHOOSE ONE: (a) more literate; (b) more threatening; (c) more romantic; or (d) more bureaucratic.

Do you need a scathing letter to your landlord threatening to haul him into court if he doesn't pump the 6 inches of raw sewage out of your bathtub immediately, or at least within 6 months if he's not to busy? No problem!

Have you been searching high and low for 50 ways to leave your lover, in print? How about an instant form letter to your long-lost relative in Chillicothe, Ohio, who's somehow traced his way through six changes of address to find you, and who now wants to borrow $75 for a new snowmobile helmet. Just use Letter 6SJ7!



Corey Sandler

Well, I suppose there really may be a market for some of these products, although I can imagine all kinds of disasters emanating from the PC of a less-than-aware letter writer. Picture the consequences if the love letter were sent to the landlord and the dunning note to the letter writer's boss!

These products also bring to mind the word game that was very much in vogue in the late fifties and early sixties. (It was commercialized into a series of *Mad Libs* books for those who needed a creative boost.) The scheme worked this way: You started with a nearly complete short story (almost any would do) and removed about 20 nouns, verbs, and other parts of speech. Then the conductor of the session would ask the participants to supply the missing parts, and they would be plugged into the story.

The results, depending upon the situation and the sobriety of the players, would range from the unusual to the bizarre to the scandalous.

Here, let me give you an example. I've chosen a press release at random from the pile sitting on the floor of my office. Write down on a piece of paper the following: a place, a date, a brand name, four different pieces of computer hardware, three adjectives, a gerund, two popular buzzwords, a famous name, and a pair of exciting verbs.

Now, plug your words into this press release:

(PLACE), (DATE) . . . The (BRAND NAME) (COMPUTER HARDWARE NOUN), introduced to-

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## SANDLER'S SCREEN

day, incorporates state-of-the-art features in a (ADJECTIVE), (ADJECTIVE) unit, and at a much lower price than that offered by any competing product.

The new product offers a greatly expanded range of capabilities, including a feature that enables a (COMPUTER HARDWARE NOUN) to emulate a (COMPUTER HARDWARE NOUN), with full (BUZZWORD) and expandability through the use of plug-in (COMPUTER HARDWARE NOUN), to be available later.

(FAMOUS NAME), president of the company, said, "The addition of (BUZZWORD) to our product means that for the first time users will be able to (VERB) charts, or (VERB) numbers, without giving up (GERUND) the bottom line. We think that is truly (ADJECTIVE)."

Look out, public relations consultants. Your days are numbered.

### Personal Use

As for my personal needs, though, I'm harder to please. I individually craft all of my letters, and they are suitable for framing by the recipient. (Well, yes, it is true that I once prepared a "search and replace" Christmas letter for my far-flung friends. But they all understood—I'm a busy man, you see.)

I do, however, have need for one letter that I find I must send once a week these days. Of late, my job has taken me pretty far afield from the comfortable environs of One Park Avenue. I've been forced to spend a lot of time in the provincial outbacks of America, in places like Boston and San Francisco and Las Vegas. My wife claims that she still recognizes me as I stand in the doorway each Friday night, but there's a certain tremulousness in her voice when she asks, "Corey?" And last Sunday, as I packed my bag for yet another trip, my baby son crawled over and deposited his pacifier in the suitcase.

So I'm working on a way to maintain regular and speedy communication with Janice and Willie. Here's the first draft of the letter my computer and I will electronic mail their way:

Dear (NAME OF WIFE):

I'm so sorry you (WERE ASLEEP, IN THE SHOWER, MISSING) this morning as I left for the (AIRPORT, TRAIN STATION, SUBMARINE BASE).

This time I'm off to (CITY) where I hope to (INTERVIEW, BE ABUSED BY, SWAP RUMORS WITH) the head of that new computer firm with the (HOT NEW, OLD STANDARD, OVER-HYPED UNDERCAPABLE) product I told you about a couple of weeks ago. Oh, by the way, please don't forget to call our broker and (BUY ALL THE IBM STOCK WE CAN AFFORD, SELL ALL THE IBM SHARES WE HAVE, MORTGAGE THE HOUSE AGAIN AND INVEST IN HOG BELLIES).

I hope you've forgiven me for that little contretemps at the neighborhood barbecue last week when I got home after dark. It truly was an accident—I didn't realize the woman I started dragging off into the bushes was (YOUR FRIEND NANCY, THE GOULDS' AU PAIR GIRL, THE SCHOOL PRINCIPAL). You have to understand, (NAME OF WIFE), how was I to know that since we've last seen each other you have (DYED YOUR HAIR PURPLE, BOUGHT A NEW DRESS, GROWN AN INCH).

Anyhow, I'll be sure to be more careful on Friday night when I get back home. And, since you asked, I will be wearing a brown tweed sport coat and carrying a beige portable computer under my right arm.

Sincerely yours,
Corey (your husband)

This letter is available for licensing for other users with similar needs. ■

*Corey Sandler is editor of* PCjr. Magazine.

# CHART YOUR PROGRESS

## SPECIALS OF THE MONTH



IBM System — Call for Pricing & Configuration

| | |
|---|---|
| Novation 1-2-3 Modem w/Crosstalk | $463 |
| Quadram 64K Ram Chips | $ 69 |
| Koala Touch Tablet | $115 |
| Quadlink (Apple/IBM Interface) | $539 |
| AST Comboplus 256K | $525 |
| Flip & File Diskette Box (Holds 50) | $22.50 |
| Verbatim Disks (D/D) | $39.00 |
| Maxell Disks (D/D) | $40.00 |
| Orange Surge Protector | $95.00 |

## HARDWARE SPECIALS

| | |
|---|---|
| ***Printers*** | |
| NEC 3530 | $1795 |
| NEC 7710 | $2295 |
| NEC 7730 | $2295 |
| NEC 3550 | $1995 |
| Diablo 620R (25 cps) | $1059 |
| Diablo 630R (40 cps) | $2019 |
| Diablo 630KSR (40 cps) | $2789 |
| Okidata ML 84 | CALL |
| Okidata ML 92 | CALL |
| Okidata ML 93 | CALL |
| IDS Prism 132 (w/sheetfeed, graphics and color) | $1629 |
| Qume Sprint II | $1429 |
| ***Monitors*** | |
| Quadram Quadchrome | $529 |
| Amdek Color II | $449 |
| Amdek 300 Green | $179 |
| Amdek 310 Amber | $189 |
| Gorilla Hi-Res Green or Amber | $ 89 |
| USI Amber | $159 |
| ***Modems*** | |
| Hayes 1200B | $439 |
| Hayes 1200 | $529 |
| Hayes 300 | $229 |
| Anchor Automation Mark VI | $179 |

## RECREATION

| | |
|---|---|
| ***Avalon Hill Game Co.*** | |
| B-1 Nuclear Bomber | $ 15 |
| Midway Campaign | $ 15 |
| Computer Stocks & Bonds | $ 17 |
| Computer Football | $ 15 |
| Computer Facts and Five | $ 17 |
| ***Broderbund Software*** | |
| Lode Runner | $ 25 |
| ***Epyx/Auto. Simulations*** | |
| Crush, Crumble & Chomp | $ 22 |
| Temple of Apshai | $ 29 |
| Upper Reaches of Apshai | $ 15 |
| Curse of Ra | $ 15 |
| Oil Barrons | $ 39 |
| ***Infocom*** | |
| Witness | $ 36 |
| Planetfall | $ 36 |
| Deadline | $ 36 |
| Zork I, II, III ea. | $ 29 |
| Starcross | $ 29 |
| Enchanter | $ 36 |
| Infidel | $ 36 |
| ***Intelligent Statements*** | |
| Ken Uston's Prof. Blackjk | $ 45 |
| ***Microsoft*** | |
| Flight Simulator | $ 36 |
| ***Odesta*** | |
| Chess | $ 49 |
| Checkers | $ 36 |
| Backgammon | $ 36 |
| ***Sublogic Communication*** | |
| "Night Mission" Pinball | $ 29 |
| ***Sir Tech*** | |
| Wizardry | $ 36 |

## EDUCATION

| | |
|---|---|
| ***Barrons*** | |
| Barron's SAT | $ 59 |
| ***CBS Software*** | |
| Match-Wits | $ 22 |
| Murder by the Dozen | $ 25 |
| Mastering the College Board | $119 |
| ***Counterpoint*** | |
| Early Games for Young Children | $ 22 |
| Early Games Match Maker | $ 22 |
| Early Games Piece of Cake | $ 22 |
| ***Davidson & Assoc.*** | |
| Word Attack | $ 36 |
| Speed Reader | $ 49 |
| Math Blaster | $ 36 |
| ***Designware*** | |
| Spellicopter | $ 29 |
| Mathmaze | $ 29 |
| Creature Creator | $ 29 |
| Spellikazam | $ 29 |
| ***Eduware*** | |
| Algebra I (req. color graphics) | $ 29 |
| ***Harcourt Brace*** | |
| S.A.T. | $ 89 |
| ***Inet*** | |
| Speed Read + | $ 53 |
| ***Learning Co.*** | |
| Moptown Parade | $ 29 |
| Moptown Hotel | $ 29 |
| Magic Spells | $ 25 |
| ***Scarborough*** | |
| Mastertype | $ 36 |
| Songwriter | $ 29 |
| ***Sirius*** | |
| Type Attack | $ 29 |
| ***Spinnaker*** | |
| Snooper Troopers 1, 2 ea. | $ 30 |
| Face Maker | $ 25 |
| Delta Drawing | $ 36 |
| Alphabet Zoo | $ 22 |

## BUSINESS

| | |
|---|---|
| DBase II (MS DOS) | $459 |
| Bank Street Writer | $ 59 |
| Personal Acct/BPI | $139 |
| General Acct/BPI | $429 |
| A/R, A/P, Payroll/ BPI ea. | $429 |
| Inventory Control/BPI | $569 |
| Home Acct. Plus | $ 95 |
| FCM | $ 79 |
| Ultra File | $105 |
| Concurrent CP/M 86 | $249 |
| CBasic 86 | $145 |
| Pascal/MT + 86 | $289 |
| Speed Programming 86 | $139 |
| CP/M 86 | $ 40 |
| Quick Code (CP/M 86) | $215 |
| Quick Code (MS Dos) | $215 |
| Smartcom II | $119 |
| Real Estate Analyzer II | $159 |
| Tax Preparer 1984 | $179 |
| Tim III | $355 |
| Fast Graphs | $250 |
| Easy Filer | $289 |
| Easy Writer II | $249 |
| Easy Speller II | $165 |
| Easy Business System | $1075 |
| Knoware | $ 69 |
| The Tax Manager | $189 |
| Wordstar | $325 |
| Mailmerge | $189 |
| Spellstar | $189 |
| Dollars & Sense | $119 |
| Microsoft Word w/Mouse | $339 |
| Multi-Tool Financial Statement | $ 72 |
| Basic Compiler | $285 |
| Multiplan | $179 |
| Fortran | $249 |
| Crosstalk XVI | $139 |
| Personal Investor | $139 |
| Peachtree Series 8 ea. | $495 |
| Peachtext 5000 | $259 |
| Norton Utilities | $ 59 |
| SPI Open Access | $429 |
| PFS Report | $ 85 |
| PFS File | $ 95 |
| PFS Write | $ 95 |
| Multimate | $289 |
| Supercalc III | $289 |
| Visi On Graph | $195 |
| Visi On Word | $295 |
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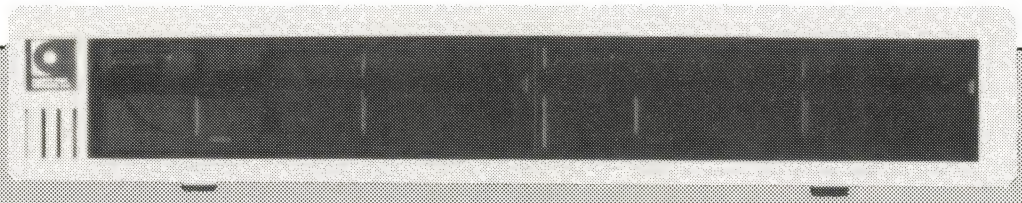
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- All cabling included.
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- Power supply designed for long life, trouble-free operation.
- Requires Maynard controller for use on PC.

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## DISK DRIVES and other Goodies!

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|---|---|
| sa-712 10MB hard disk-half hgt | $795.00 |
| sa-860 ds/dd half hgt 8" | 505.00 2 @ 495 ea |
| sa-455 ds 48tpi ½ hgt 5.25" | 245.00 2 @ 230 ea |
| sa-465 ds 96tpi ½ hgt 5.25" | 295.00 2 @ 275 ea |
| sa-300 ss 96tpi 3.5 inch | 265.00 2 @ 250 ea |
| sa-851 ds 8" full size | 495.00 2 @ 480 ea |

**W.S.T.** (formerly SIEMENS)

| | |
|---|---|
| FDD-100-5B4 flippy 5.25" | 235.00 |
| FDD-211-5 DS 48tpi for PC | 265.00 |
| FDD-221-5 DS 96tpi full size | 335.00 |
| FDD-100-5C3 (sa-400 compatible) | 175.00 |

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|---|---|
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| 64K | 305.00 |
| 128K | 410.00 |
| 192K | 510.00 |
| 256K | 615.00 |
| With serial port add | 100.00 |
| With 2 serial ports | 160.00 |
| Controller w/mod ports | 265.00 |
| FDC8 8" controller | 245.00 |
| Standard controller | $195.00 |
| Controller w/par port | 275.00 |
| Controller w/ser port | 285.00 |
| Hard disk module | 495.00 |
| Modular board | 110.00 |
| Multidisplay (mono & color board) | 575.00 |
| PGS, HX-12 RGB color monitor | 525.00 |
| Magnolia controller for the H-89 | 375.00 |
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| Power connectors for all drives | **CALL** |

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# Words to the Wise

## Two new word games for the PC, Tic Tac Show and Spellakazam, are good educational tools, fun to play, and they are not necessarily just kids' stuff.

People have always been fascinated by good word games, in part because the skills required to play them are perceived as valuable. We use words constantly, and anything that helps us learn more about them, or more *of* them, is not a trivial pursuit. Word games are mentally stimulating, and, like the two reviewed here, *Tic Tac Show* and *Spellakazam,* many are both educational and fun to play. These games were designed for children, but they are not just kids' stuff.

*Tic Tac Show*'s format is a cross between traditional tic-tac-toe and a trivia quiz. To win, you must claim three squares in a row by correctly answering the questions "behind" those squares. A correct answer gains one point and places your symbol (X or O) in the square. An incorrect answer gives the square to your opponent, but no point is awarded. Thus, you must choose squares that will help if you answer correctly, but will not help your opponent if you answer incorrectly.




**In this screen from *Tic Tac Show,* the game's "hostess," Carol, corrects an answer to a sports question. As in a television show, names and scores appear on her "desk."**

The main menu presents you with three choices: play the game, build or change your own game, or quit. The disk also includes a demonstration that will begin in 30 seconds if no keys are pressed. Once you elect to play a game, you are prompted to answer a number of questions: "Do you want sound effects? What is your name? Will someone else play also? What is his or her name? Would you like instructions?" It would be difficult for even a child to get lost in this game.

The computer then builds a game around any of 22 subject areas on the game disk, or you can create your own disk that covers a subject of your choice. The preprogrammed subject files cover such topics as United States presidents, nursery rhymes, the human body, mythology, sports, and academic subjects like math, French, and elementary science.

***Tic Tac Show***
Computer Advanced Ideas, Inc.
2550 Ninth St., #104
Berkeley, CA 94710
(415) 526-9100
**List Price:** $39.95
**Requires:** 64K RAM (DOS 1.1) or 128K RAM (DOS 2.x), one disk drive, color/graphics adapter.

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The play of the game alternates turns between you and your human opponent or between you and the computer. A cute graphic of the show's hostess, who is named Carol, keeps the game moving; prompts appear above her head in cartoon-type bubbles. She might say, for example, "Phil, it's your turn to pick a box." I would then look at the nine squares forming the tac-tac-toe board and make my selection. A question would appear in one of four formats: multiple-choice, fill-in-the-blank, true-or-false, or question-and-answer. Although you never know which question is going to pop up behind a particular square, the question behind the central, most strategic one is always a doozie. A round ends when you or your opponent gets three squares in a row or when a tie occurs. In this case, the round is awarded to the player with the most points. At the end of any round, you can stay with the same subject, exchange it for another, or exit the program.

You may be wondering what happens when you know the answer to most of the questions in the 22 subject areas. You use *Tic Tac Show*'s mini-authoring system to create your own subject. This feature allows you to determine the level of difficulty too, so for many players, the authoring system may be the most appealing aspect of the game. Say, for example, your child is having trouble with trigonometry, you can create games on that subject, tailored to his exact needs. And you can update the material at any time. An even better way to teach a child about trigonometry might be to have your child create a game on that subject for you to play. Give the child some reference books, let him search for the answers and the questions, and then create a game to check the work.

Tic Tac Show's format is a cross between traditional tic-tac-toe and a trivia quiz.

*Tic Tac Show* is an excellent family game, and using it to create your own games makes it an introducton to computers, too. It uses sound effects and animated color graphics, although neither of these features are particularly strong.

On *PC*'s scale of one to six, *Tic Tac Show* rates:

| | |
|---|---|
| FUN: | 4.5 |
| CHALLENGE: | 4.0 |
| GRAPHICS/SOUND: | 3.5 |
| TOTAL SCORE: | 12.0 |

***Spellakazam***
DesignWare, Inc.
185 Berry St., Building 3, #158
San Francisco, CA 94107
(415) 546-1866
**List Price:** $39.95
**Requires:** 64K RAM, one disk drive, color/graphics adapter.

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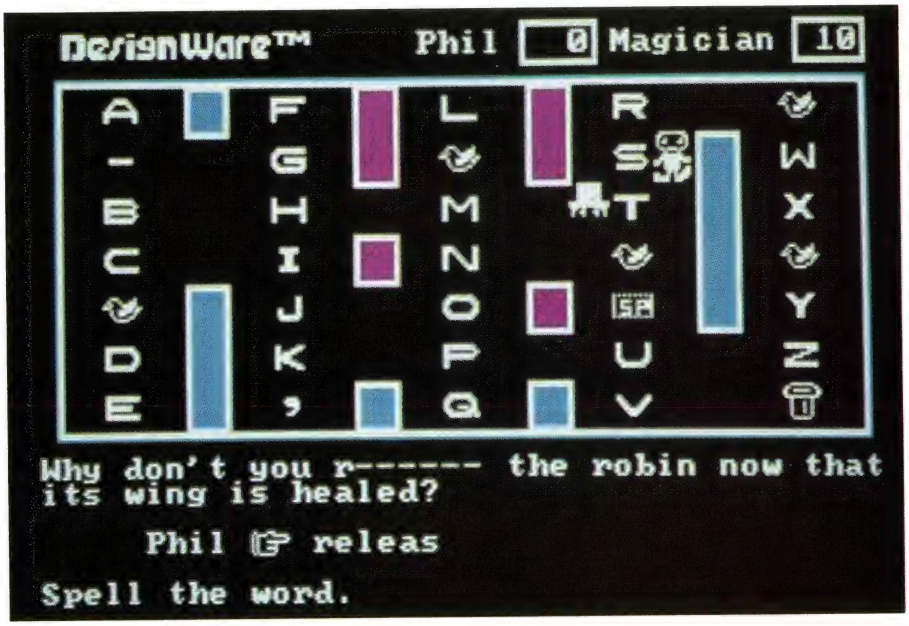
DesignWare developed *Spellakazam* in conjunction with Silver Burdett, a well-known publisher of educational materials. It is designed to teach kids in grades 2 through 8 how to spell. In fact, the 400 words on the game's 20 spelling lists were culled from a successful textbook series titled *Silver Burdett Spelling*. So why not just give your child the books, which are more comprehensive? Why should children learn to spell from a computer?

The answer to the first question is easy once you've seen the game: *Spellakazam* not only teaches spelling, it is an entertaining maze/race game that children are likely to stay with long past the day they can spell the word *acquaintance*. The answer to the second question is not so obvious: You can use this software to create your own games, fine-tuned and updated to suit the changing needs of your children.

There are two games in *Spellakazam*. Both are for either one or two players but only one game is in effect at any time. In

Game 1, the player's character appears next to a computer-controlled magician in the upper left corner of the maze, which also contains the letters of the alphabet and some other symbols. The maze construction was kept simple to appeal to 7 to 14-year-olds. At the bottom of the screen is a sentence with a word missing, represented by the right number of blank spaces. The object is to spell the missing word by moving a character through the maze to pick up the letters in order, and then pick up the magician's hat in the lower right corner to end the round.

Fortunately, a round will not begin until you move your character, which gives you all the time you need both to figure out the word that fits the sentence and to plan a strategic route for picking up its letters. Once you start your character moving, the magician begins to steadily




**To finish the word *release* "Phil" must thread through the maze to pick up the final e.**


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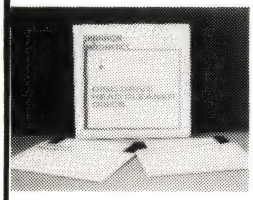
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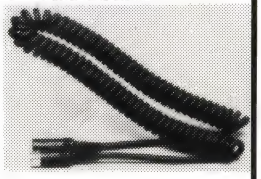
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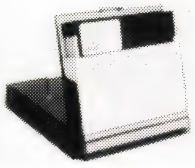




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make his way through the maze towards his magic hat. You pick up a letter by moving your character next to it and pressing the joystick button or spacebar. The letter immediately appears next to your name. You can drop a wrong letter by pressing the second joystick button or the Return key. One warning: *Spellakazam* is really designed for joystick play, so using the keyboard is difficult.

If you can pick up the letters to spell the word that belongs in the sentence and get to the magician's hat before he does, you will earn bonus points. Since the magician moves quickly and without mistakes, the game allows players to send the magician back to the maze's starting point by picking up one of the bird symbols. This move doesn't interfere with spelling the word, but each bird you use costs you two points.

In the more challenging *Spellakazam* Game 2, the magician no longer just heads for his hat—he tries to spell the same word you're trying to spell. Otherwise, everything works the same as in Game 1. In both games, whether or not you beat the magician, you get a visual surprise as well as points each time a word is spelled correctly—a little creature jumps out of the hat and places the word in the sentence. If the word is spelled incorrectly, a line is drawn through it, the correct spelling is shown, and you are allowed another chance to spell it correctly by moving through the maze a second time. The computer will use that word again later.

Each round is played using one list of 10 to 30 words. The 20-word lists that come programmed on the disk are labeled for grades 2 through 8; there are also three speed settings that create 21 different skill levels. Each word list is built around a specific spelling rule, such as "short vowels" for a second-grade list. Before setting up the game, the computer displays the spelling rule followed by the word list. Then it asks if you want to use that word list and whether you want to play with core words only (10 words), core and basic words (20), or core, basic, and bonus words (30). The player decides whether to preview the word list.

The 400 words on the spelling lists represent common spelling rules as well as commonly misspelled words and are the result of years of language research by the Silver Burdett Company.

A round does not end until all players have spelled all words on the list correctly, at which point the computer displays a progress report for each player that might say: "Phil, you spelled the words correctly on the first try seven out of ten times. Words you need to practice are . . ."

> Spellakazam is really designed for joystick play, so using the keyboard is difficult.

You can create your own games of *Spellakazam* by assembling word lists, spelling rules, and context sentences and storing them on a blank disk. To show my adult friends how challenging this "kids' stuff" can be, I've created games using very difficult words and obscure context sentences. You can also set up other kinds of games, like quizzes on United States presidents in which the child not only has to spell the names but must guess them in the first place. For example: "President -------- had the most children of any president (ten), and died in office."

*Spellakazam* will appeal to a younger and smaller age range than *Tic Tac Show,* but only because it was designed around a much more specific skill. As a supplement to, not a replacement for, classroom learning, the program is very good, particularly if you create games from your children's weekly school spelling lists.

On *PC*'s scale of one to six, *Spellakazam* rates:

| | |
|---|---|
| FUN: | 4.5 |
| CHALLENGE: | 4.5 |
| GRAPHICS/SOUND: | 3.5 |
| TOTAL SCORE: | 12.5 |

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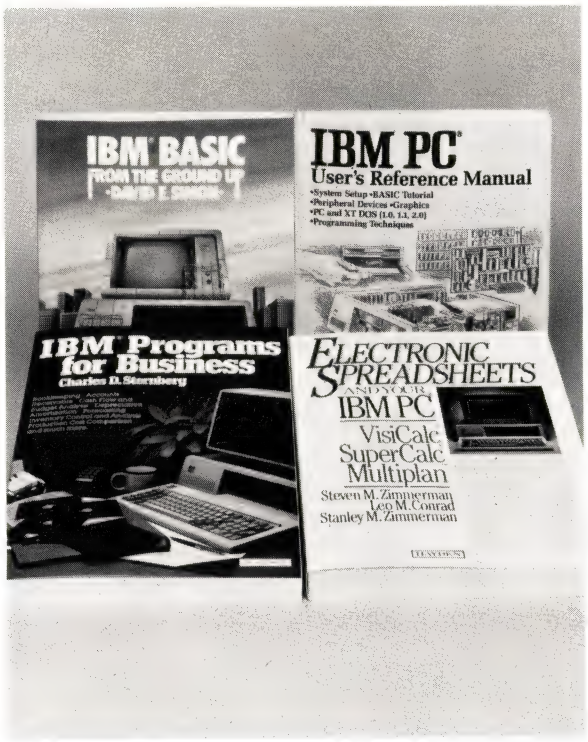
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# d foreign language.

```
.list files
    DATABASE  FILES  NBRRCDS  LAST UPDATE
     HOMES    DBF     1005     11/01/83
.use homes
.list homes selling for<50000
*** SYNTAX ERROR *** RE-ENTER
.list structure
    FLD    NAME     TYPE   WIDTH   DEC
    001  ADDRESS     C       025
    002 SELLPRICE    N       009     002
    003   AGENT      C       025
.list for sellprice<50000
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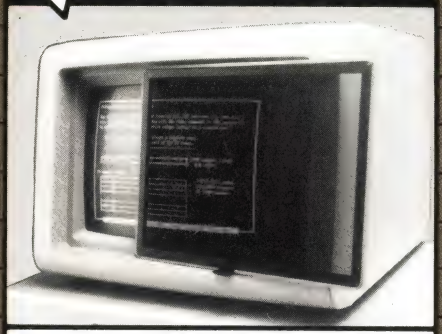
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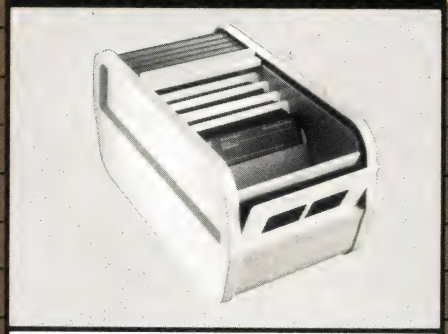
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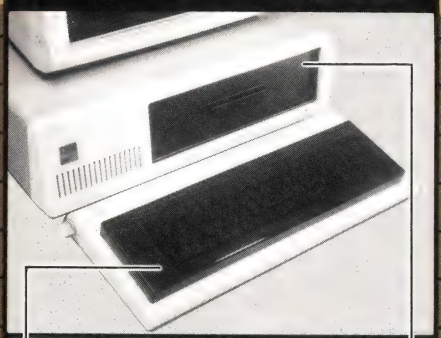
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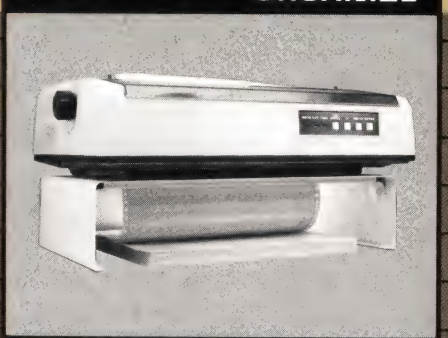
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# Introducing The PC Family

The background, technical, and programming material in this quartet of new introductory books on the PC, XT, and PCjr can be a great help to new owners as well as to prospective buyers.

If you are the owner of a new IBM PC or PC*jr*, hope to own one soon, or are just interested in IBM personal computers, you might find one of the many available introductory books on these machines helpful. The four reviewed here give background information on computers, describe their particular machines exhaustively, and discuss the software available for them.

Que Corporation has just published an updated edition of its popular *IBM's Personal Computer*, a comprehensive primer for the PC that was one of the first such books when it was published in February 1982. The first edition covered the original IBM PC; this update discusses the XT and PC-DOS 2.0. The two editions are quite similar.

The book first discusses the PC's place in today's world, briefly describing some of IBM's small business computers and comparing the PC with other microcomputers on the market. It next covers the system unit and peripheral hardware in great detail. You will probably learn more about the 6845 CRT controller chip and the PC's other hardware from this book than you cared to know. Chapter 4 looks at the operating systems that the PC uses and compares PC-DOS with CP/M-86.




One lengthy section examines a few of the hundreds of programs that now run on the PC, and another gives a good introduction to personal computer communications. The final chapter discusses purchasing a PC, installation, warranties, and service. *IBM's Personal Computer* includes an excellent glossary and several useful appendices that list all IBM BASIC commands and statements.

*IBM's Personal Computer* assembles and presents basic information in a way that technically unsophisticated readers will understand. With this book, potential PC buyers can learn more about the system in a couple of evenings at home than they could glean from many hours of discussion with most computer salespeople.

Que Corporation's *Introducing IBM PC*jr is one of the first books out on IBM's latest entry in the microcomputer market. It follows much the same format as *IBM's Personal Computer*.

Since PC*jr* was designed for the first-time computer user, this book was written with novices in mind. It answers such questions as "Can I learn to use a computer?", "Can I break the computer?", and "How can I get my computer fixed?" Douglas Ford Cobb and Chris DeVoney describe how microcomputers work by using analogies that make the subject understandable to the uninitiated.

The book briefly describes IBM itself and the events that led up to the PC*jr*'s announcement, including the rumors that circulated during the summer of 1983.

Cobb and DeVoney cover the PC*jr*'s hardware in detail in Chapter 3. They compare the 8088 microprocessor with the

***IBM's Personal Computer***
(Que Corporation, 7999 Knue Rd., Indianapolis, IN 46250
[317] 842-7162, 1983)
300 pages; softcover; $14.95 (1st edition)
336 pages; softcover; $15.95 (2nd edition)

CIRCLE 704 ON READER SERVICE CARD

PC's 8086 and with other 16-bit processors. They describe each peripheral and discuss its design, including the new infrared-link keyboard. The authors devote an entire chapter to DOS 2.1, in which they briefly describe each command and feature.

In Chapter 5, the authors explain the differences among the various versions of BASIC for the PC*jr*—Cassette BASIC, Cartridge BASIC, and Compiled BASIC—and compare them to the PC's Disk BASIC and BASICA. Cartridge BASIC, the newest version, is particularly carefully dissected. The authors also describe IBM's Logo and the Macro Assembler in nontechnical terms.

Like the PC book, *Introducing IBM PC*jr reviews software currently available for the machine, devoting a chapter each to personal management, educational, and entertainment software. Each program review lists the system requirements and the price. The reviews are good and will help you make an educated selection.

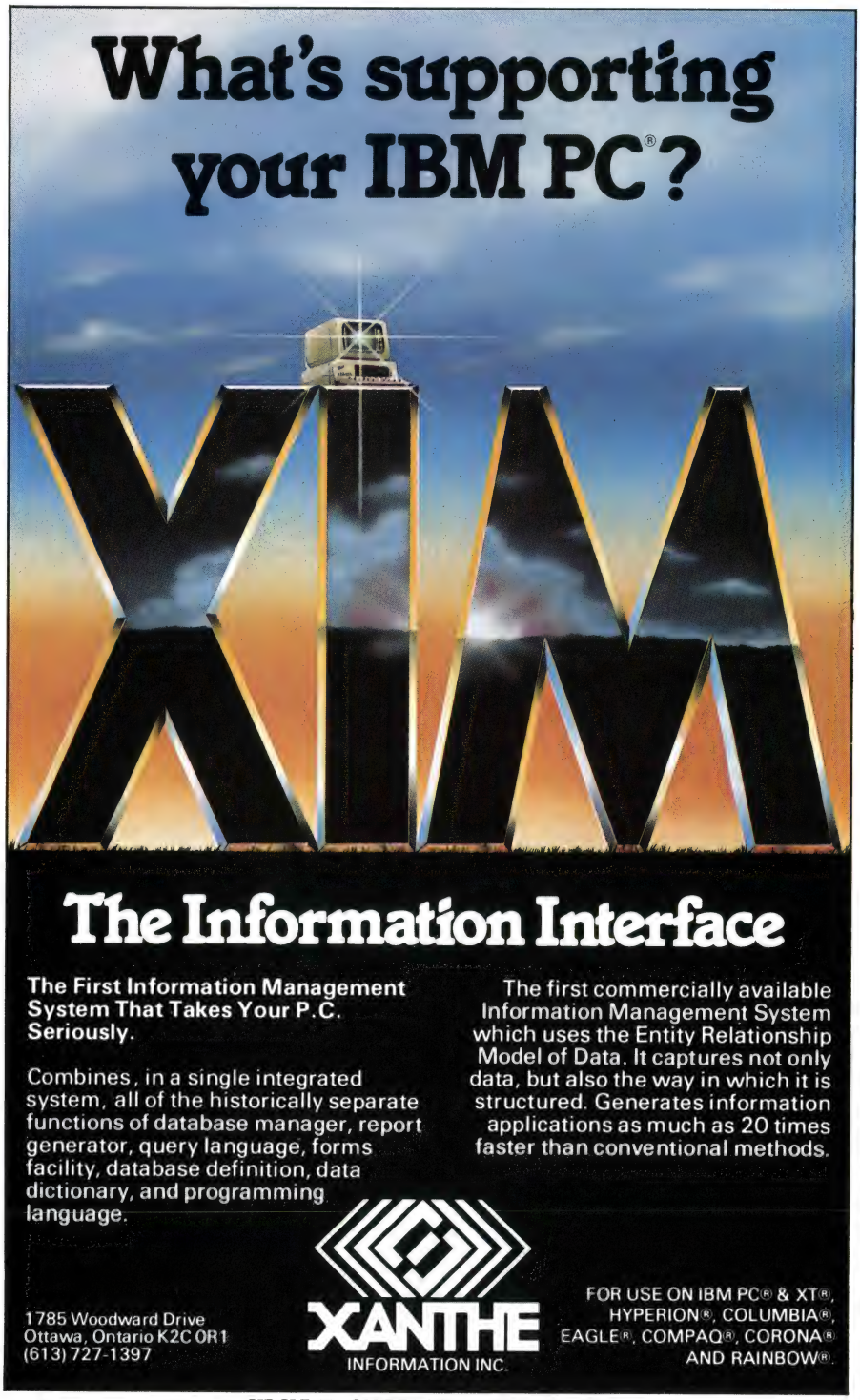
The authors explain the differences among the various versions of BASIC for the PCjr.

The book's most useful chapter, "Putting It All Together," catalogues and prices all the hardware and software you would need for a complete PC*jr* system. Such a system turns out to be a lot more expensive than most people might think.

*Introducing IBM PC*jr's last two chapters examine the machine's competition (such as the Apple IIe and the Atari game computers) and speculate on possible future expansion of the PC*jr*. The chapter on expansion, which makes particularly interesting reading, describes the areas in which competitors are likely to market

***Introducing IBM PC*jr**
Douglas Ford Cobb and Chris DeVoney
(Que Corporation, 7999 Knue Rd., Indianapolis, IN 46250
[317] 842-7162, 1983)
245 pages; softcover; $9.95

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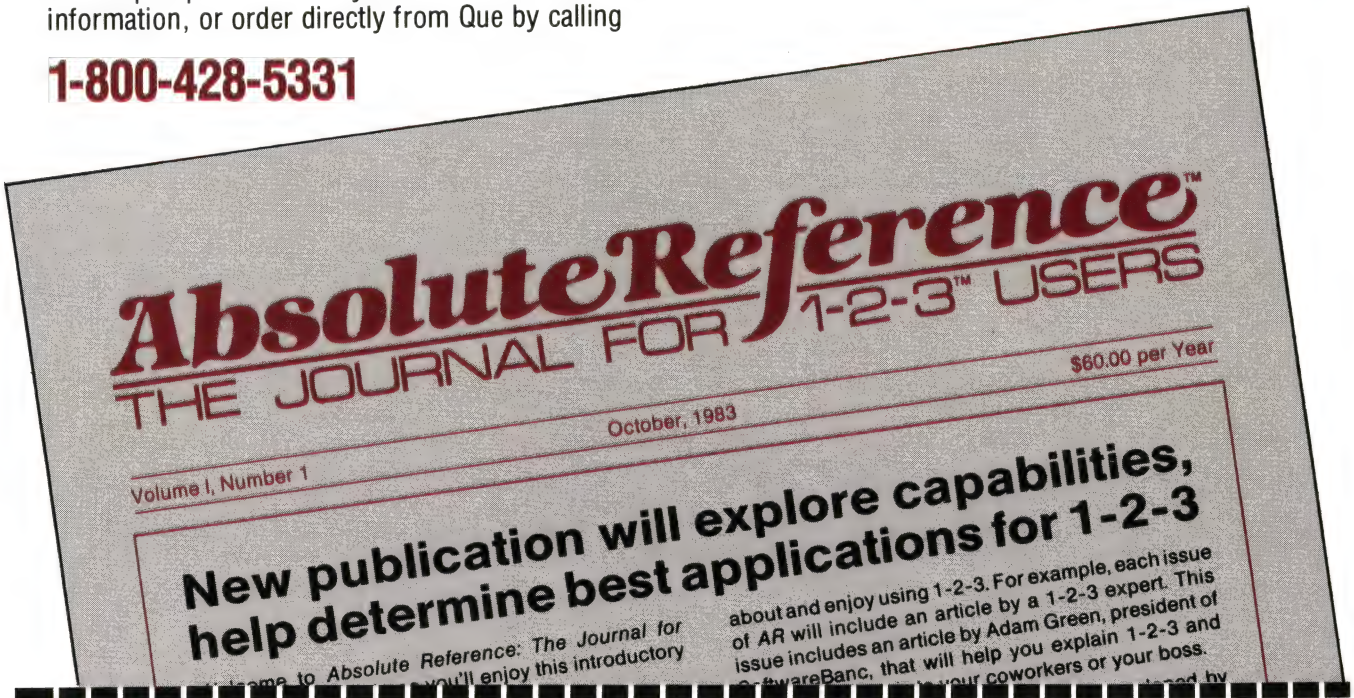
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add-on products for the PC*jr*.

*Introducing IBM PC*jr is a comprehensive primer that should be required reading for anyone contemplating a PC*jr* purchase.

*IBM PC—An Introduction to the Operating System, BASIC Programming and Applications* is actually the second edition of a previous book by Goldstein and Goldstein titled *IBM Personal Computer—An Introduction to Programming and Applications*. Despite the similarity in the titles, the two books are very different; the authors have done a very thorough revision.

Intended to teach the computer novice IBM PC fundamentals, the contents of the book range from a general primer on computers to a brief description of assembly language. Many of the chapters include practice exercises and "test your understanding" questions. Technical descriptions and details are kept to a minimum.

The first 60 pages contain basic instructions on using your PC, beginning with how to turn it on and moving on to the keyboard and DOS.

The rest of the book is primarily devoted to a clear and concise introduction to PC BASIC. It provides a solid grounding without getting bogged down in the details that might cause a novice to give up. Examples and exercises reinforce the basic instruction. Some of the chapters in the BASIC section cover getting started, working with data, files, graphics, games, and types of numbers. The sequence in which these topics are covered differs from the norm in books of this type, but it works well with the approach the authors have selected. The chapters on BASIC will teach you enough for most home programming purposes.

A section at the back of the book called "Answers to Selected Exercises" contains program listings, flowcharts, and other answers that are not in the text. Also at the end of the book are three tear-out cards. The first lists all the DOS 2.0 commands, briefly explains each, and describes their formats. The second is a reference for PC BASIC commands. The third lists BASIC 2.0 error messages. These reference cards are real timesavers when you just want to look up the format of a command or find out what an error number means.

Goldstein and Goldstein have written a winner. If you are the owner of a new IBM PC and don't yet feel comfortable with it, this book will go a long way toward making you feel like an experienced computer user.

***IBM PC—An Introduction to the Operating System, BASIC Programming, and Applications***
Larry Joel Goldstein and Martin Goldstein
(Robert J. Brady Company, Bowie, MD 20715
[301] 262-6300, 1983)
392 pages; softcover; $14.95

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***IBM PC*jr *Favorite Programs Explained***
Donald C. Kreutner
(Que Corporation, 7999 Knue Rd. Indianapolis, IN 46250
[317] 842-7162, 1984)
189 pages; softcover; $12.95

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In *IBM PC*jr *Favorite Programs Explained,* author Donald C. Kreutner gives 40 BASIC program listings, each with informative text explaining some of the program's internal workings so you can follow its flow. This format is identical to the one Kreutner used in his two well-received previous books explaining programs for the TI 99/4A and Commodore 64 computers. The PC*jr* book was written for the novice BASIC programmer and includes 35 pages of PC*jr* BASIC commands, statements, and functions with examples.

One problem with this book is that some of its programs don't operate the way the text and the illustrations indicate they will. The problems are small, such as a title that prints at the bottom of the screen instead of at the top as the illustration shows, but novice programmers need exact results. Experienced programmers can examine the program and realize that the title is supposed to print at the bottom, but novices immediately look for what they did wrong. The other problem is really just an irritant. Kreutner has committed an unpardonable sin common to many people who write books of program listings—his line numbers are not consecutive increments of 10! Even if his programs required some debugging before publication, the PC's (and PC*jr*'s) RENUM command could easily have fixed the line numbers. It is bad enough to have to enter a program by hand—this problem prevents you from even using the AUTO line numbering function.

IBM PCjr Favorite Programs Explained gives 40 BASIC program listings with text explaining the program's inner workings.

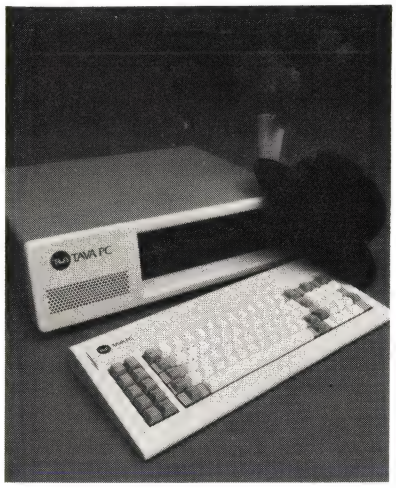
Books written for beginners should meet a higher standard than those for more experienced programmers; this one doesn't quite measure up. Using useful BASIC programs as teaching tools is a good approach and deserves more careful attention to detail than the author has given here.

The number of computer books on bookstore shelves is increasing daily. These books can save you time, money, and frustration by giving you a solid base of information before you leave the house to do your computer shopping. ■

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# Creating Order From Chaos

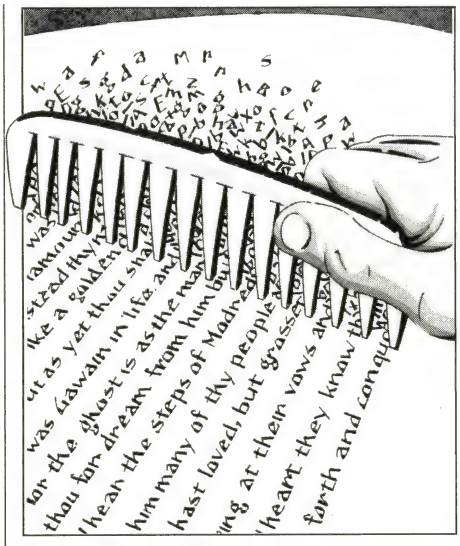
## Whether you begin the writing process by making a rigid outline or by brainstorming randomly, there's a program that can help you organize your thoughts on the screen instead of on paper.

Few people attack writing projects head on. For most, there's a crucial period of trial runs, paper shuffling, desk cleaning, and looking through notes and references. You don't have to give up this approach entirely when you begin writing on a PC. A growing number of programs are designed to help you get organized on the screen instead of on paper.

Arranging thoughts on paper and fleshing them out with the facts are the foundations of most good writing. Database managers and card file programs are useful tools for organizing facts (see "Getting Organized on Your PC," *PC*, Volume 3 Number 5, and "PC Filing: It's in the Cards," *PC*, Volume 3 Number 7). Here's another group of programs to help you move smoothly from data to prose.

The method that will work best for you depends on your personal working style. You may be attracted to a clearly structured approach that works like a blueprint to give your project a definite shape. Or you might prefer a more free-form approach in which your work coalesces into form out of apparent chaos. Some people stick with the same technique all the time; others vary depending on mood and project.

If you start your writing projects with a strong outline written on a yellow pad, the best program for you may be *ThinkTank*



from Living Videotext in Palo Alto, California. This program combines a normal text editor with an editor/formatter designed specifically for outlines.

With *ThinkTank*, you create your outline as a series of headings, each indented to show its relation to others. *ThinkTank* can show you an overall display of major headings or you can zoom in for a closer look at particular sections.

Along with each heading you can enter a "paragraph" of text—actually up to 20,000 characters with breaks and indents. When you print out your file you can print the headings, the text, or both. This means that once you have finished your outline and filled in your text beneath the proper headings, you can print out a final document without reformatting your file or editing out the headings.

If outlines cramp your style, and you prefer to make notes in your margins and draw arrows back and forth between paragraphs, you might be happier with *The Idea Processor* from IdeaWare in New York City. It's an integrated word processor and card file that meshes the two functions quite smoothly. Like *1-2-3*, *The Idea Processor* not only performs its individual functions well but makes them all the more useful by providing easy routes from one mode to another.

As a card file, *The Idea Processor* is comparable with other standard filing programs. You enter data on individual "cards," which in turn are grouped in "drawers" and "cabinets." The data are indexed by keyword, and you can call up cards using a selection of keywords or keyword combinations.

### Card Shark

Each entry can be up to 8,000 characters long, and you can use a full set of word processing commands to edit each card. You can "import" files onto cards (providing they're within the size limit) and write cards out to PC-DOS files. Unfortunately there is no automatic keyword generation, so you have to declare the keywords yourself, and you're limited

Illustration: Phillip Anderson

to declaring a mere ten per card.

When you're working with the editor you can switch directly into the card file at any time. You can mark sections of text in your main document and copy them to a card or bring the contents of a card back into the text. You can even include special commands on your cards to reference graphic displays. Then, if you have a color monitor, the appropriate image will appear on the color display while you edit the accompanying text on the monochrome monitor.

Like most people who deal in information, I keep scores of three-ring notebooks, but I don't always make good use of them because it gets harder and harder to remember what information is written where.

*Notebook*, distributed by Digital Marketing in Walnut Creek, California, is essentially a three-way cross between a database, a card file system, and a text editor. As in a database, you define a record format to store your information. As in a card file, you can type text in free

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(212) 334-8403
**List Price:** $295
**Requires:** 192K RAM, two double-sided, double density disk drives.

CIRCLE 730 ON READER SERVICE CARD

***Notebook***
Pro/Tem Software
Distributed by Digital Marketing Corp.
2363 Boulevard Circle
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**Requires:** 128K RAM, two disk drives, PC-DOS.

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format within each field. And as in a text editor, you can add, delete, search, replace, and format the text.

This combination works well for structured records. The examples in *Notebook*'s tutorials include phonograph record collections, address lists, bibliographies, and recipes. The file searching and reporting functions are good, and the editor is adequate.

I had hoped for a smoother interface back and forth from long text documents. However, the manufacturer seems to have a regular revision cycle so I may get my wish in the next version of *Notebook*. Meanwhile, even the older versions may fit the bill for your needs. (For more on *Notebook* and other programs by Digital Marketing Corp., see "The Researcher's Assistant," *PC*, Volume 3 Number 1.)

### Needles in Haystacks

*Notebook*, *The Idea Processor*, and *ThinkTank* are all practical for smaller files of data, but they're not really well suited for files that run into megabytes. If your writing project depends on finding data that you know is filed somewhere in your enormous system, you may need a text search program. *FYI 3000* from FYI, Inc., in Austin, Texas, or *ZyINDEX* from ZyLAB Corporation in Chicago, can index hundreds of files either by a selected word list or by every significant word in the files. They're best suited for hard disk systems, but for smaller projects you can get along with floppies.

To use either program, you take all your files concerning a particular topic and

***FYI 3000***
FYI, Inc.
P.O. Box 26481
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**List Price:** $395
**Requires:** 128K RAM, two disk drives.

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***ZyINDEX***
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Program by Paul Arlton & Ed Dawson.

CIRCLE 493 ON READER SERVICE CARD



run them through the indexing function. Although the indexing can take a few minutes per file, the process is fairly automatic, and you don't have to pay attention to the screen. Once the files are indexed, you can ask the program where any word or combination of words is located.

Using these programs is similar to using a commercial databank. You formulate an initial search and then narrow or widen it until you have a reasonable number of "hits" to look at. You can view the matching sections, print out the files containing them, or copy selected sections of text to a new file. If you anticipate repeating a search or performing a related one, you can store your search criteria for later reuse.

A feature of *ZyINDEX* that I particularly like is a "distance" criterion: You can specify that a matching file must contain two selected words with no more than a specified number of words between them. The manual shows how useful this would be for searching letters pertaining to a scientific research project, but I've also found it useful in editing my novel. Because I've started and stopped several times, I don't always remember all the details of each character's life; with *ZyINDEX* I can search for a character's name by typing in the word name/the word "years" to find his age, or name and "hair or locks or mane" to find hair color.

### The Best Is Yet to Come

None of the programs mentioned here can even approximate the efforts of a trained researcher working with even a simple line editor. Because all the programs deal with words strictly as character strings and without any consideration of meaning, what would be obvious to a person is blithely ignored by a computer. Eventually artificial-intelligence techniques will appear in these types of programs and we'll be able to place more confidence in their abilities. Until then, these programs can only help supply order and arrangement. Judgment, craft, and beauty are still up to you. ■

# Legal Persuasion

## Lawyers are increasingly using graphics and spreadsheet software to support their arguments and clarify their opinions. Multiplan and 1-2-3 are two favored packages.

Red, green, and turquoise bars, blue and orange curves, jagged purple and brown peaks marching through black grid lines. Would you have taken this graph for a legal opinion?

Well, it may not look like one, but that's the form in which opinions are emerging from more and more law offices—as art-department-style graphics created at the flick of a computer key.

In the midtown-Manhattan office of Windles, Marx, Davies & Ives, paralegal Chuck Silva keys into his IBM PC the weekly and monthly Department of Commerce figures on steel import quantities, domestic production, and percentage of production capacity utilization. Silva is assistant to Pierre de Ravel d'Esclapon, who represents foreign steel producers. Silva works from dozens of mind-numbing pages of single-spaced typed statistics, the kind that induce an instant case of MEGO ("my eyes glaze over").

But wait! With a few more keystrokes, Silva converts these indigestible numbers to glorious graphs using Lotus' *1-2-3*. Suddenly, relationships one could perceive only after hours of tedious study become readily apparent as the brightly colored shapes emerge from the Hewlett-Packard HP 7470A plotter.

Do you want to know what percentage of steel consumed in the United States is imported from Europe? Whether imports are displacing domestic production? Or if the quotas are too high? See the chart in Figure 1. Pierre de Ravel d'Esclapon uses *1-2-3* graphs of such trends, complete with seasonal variations, for his forecasts, which he inserts into briefs on international trade controversies submitted to foreign and domestic government agencies.



Illustration: Michael Ng

### Fascination

"I'm fascinated by technology," says de Ravel d'Esclapon. "The *1-2-3* graphics permit me to make a more persuasive case than I can with pages of pure numbers. It saves analysis time, too. The human mind grasps an analog presentation faster and better than a digital one."

What is on de Ravel d'Esclapon's *1-2-3* wish list? "I wish *1-2-3* had telecommunications capabilities so we could access government databases directly. Now, we have to rekey everything we get from them because *1-2-3* is incompatible. I look forward to evaluating Lotus' *Symphony* program as soon as it's available."

Paralegal Silva, who starts law school at Harvard in the fall, has found himself becoming a computer "expert" for the firm. "Now that other lawyers in the office have seen what we are turning out, they come to me with reams of numerical data and say, 'Can you put this on the computer?' I explain that it isn't that sim-



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ple. I have to know something about what the lawyer is trying to demonstrate and how the numbers are pertinent. After we've talked it over and the lawyer has taken me through the materials," says Silva, "I'm in a position to start setting up charts and graphs for a trial run. For example, for a civil rights case I've done statistical graphs analyzing an employer's past employment practices. They show the percentage of women and minority group members hired, how long they remained in their jobs, the history of their promotions, and so on."

## Tax Alternatives

Downtown at Fried, Frank, Harris, Schriver & Jacobson, tax lawyer Joel Scharfstein talked his law firm into buying an IBM PC "without having a specific project in mind—just because I knew it would be useful."

And useful it is. At first, Scharfstein used *1-2-3*'s spreadsheet function to help his clients plan for the alternative minimum tax. With *1-2-3*, he could show clients how his legal advice would affect the bottom line without having to call in accountants. "*1-2-3* prevents us from making arithmetic errors," Scharfstein says. "Now that I've taught four of the other lawyers how to use *1-2-3*, they have it doing real estate spreadsheets and I can't get the machine back." When it comes to the crunch, Scharfstein takes work home with him and uses *1-2-3* on his own IBM PC, which is hooked up to Lexis, the legal research database subscribed to by his firm.

## Student Problems

In academia, Harvey Dale, a professor at New York University Law School, has not yet felt a need for *1-2-3*'s graphics and prefers what he feels to be the stronger spreadsheet features of *Multiplan*. At Cadwalader, Wickersham & Taft, where he is counsel, Dale uses his own templates and formulas to analyze the tax consequences and financial prospects of leasing arrangements he has structured for clients. "The *Multiplan* columnar formatting is especially useful for presentations. I like being able to link a number of columns at the top of a spreadsheet so I can have headings running across several columns of figures that each have subheadings," he says.

Dale teaches often by posing problems for his students to solve. For his tax classes, Dale uses *Multiplan* to structure his hypothetical questions so that students can work with realistic figures without having to worry about pennies. *Multiplan* does "what if" calculations that enable Dale to design classroom problems with potential results such as $100, $200, and $300. Depending on which number students arrive at, Dale can tell not only when students' answers are wrong, but also the route they took and where they went off the track.

"I am a certifiable computer freak," says Dale. Fortunately, NYU Law School has 40 IBM PCs "just for faculty fingertips," with 15 more expected next year. "For tax questions, you can take good advantage of *Multiplan*'s capacity to solve equations with multiple dependent variables or circular equations through its reiteration feature," says Dale. "This feature is needed with estate tax planning formulas for the optimum marital deduction or even for simple problems, such as figuring the pay of a salesman who earns 10 percent of net sales."

## Real Estate Projections

After several years of working with *VisiCalc* and *SuperCalc*, Martin Cowan, tax partner at Milbank, Tweed, Hadley & McCloy, is now learning *1-2-3*. "It has a great deal more potential," he says. "It lets you put all the information in one place and then pull out whatever you need, which facilitates record keeping and access." In the past, when called on to help design real estate projects attractive to outside investors, Cowan discussed broad concepts with his clients and then turned things over to accountants, who then performed the financial projections and anal-

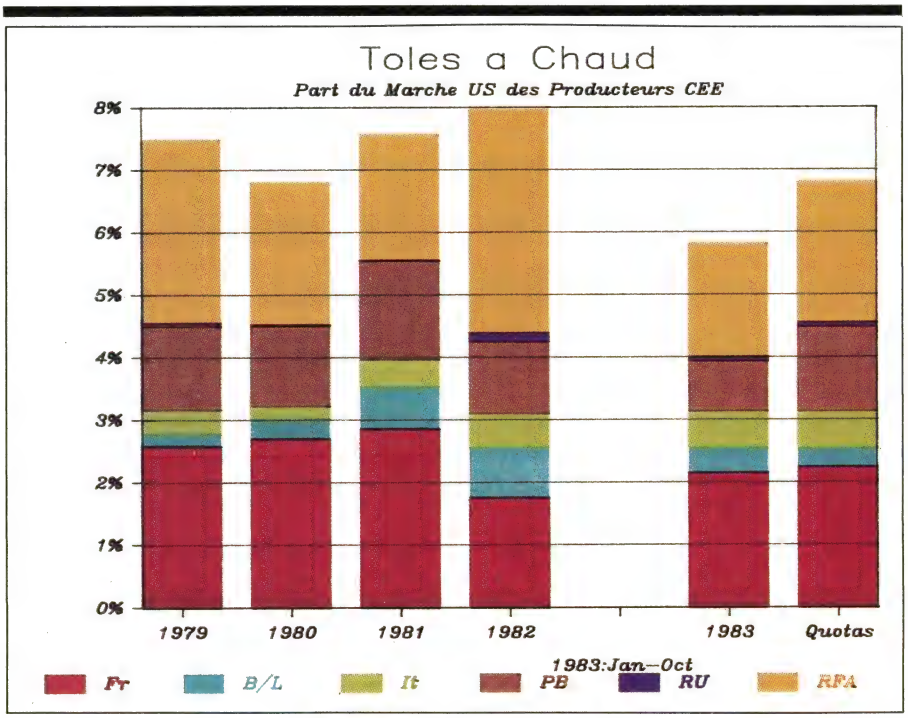



**Figure 1:** *This bar graph, showing the portion of the U.S. market for hot-rolled steel held by European producers, was created using* 1-2-3 *for a French client by Chuck Silva of Windels, Marx, Davies & Ives.*

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yses. Sometimes the result followed his guidelines, but sometimes he was not so sure they did.

Now Cowan can discuss alternate concepts and plug the numbers into *1-2-3* while his clients are sitting in his office. They can all watch how different parameters will affect the project as Cowan feeds in varying real estate tax rates, rental income, and interest rates. "I'm concerned with whether a project will be profitable before taxes, so I need to see the critical turning points for profitability. "Being able to run the numbers myself gives me a better insight into the assumptions made in the financial projections," Cowan says. "If the figures are constructed entirely by outside accountants, I have to dig to find out what the numbers represent. Have the accountants built in an inflation factor? What occupancy rate have they assumed? I like to know what the assumptions are and be able to see their effects without waiting days or weeks to get the financial analysis back."

Being able to run the numbers myself gives me a better insight into the assumptions made in financial projections.

Cowan thinks the templates available for *1-2-3* are great, too. "I found one for just $15 that will let you print out a Form 1040 if you already have *1-2-3*. Now," he says, "if only we could get the extract function to work with its data sorting command . . ." ■

*Laura Lou Meadows is a New York City-based tax lawyer with over 20 years of experience. Her IBM PC has increased her productivity.*

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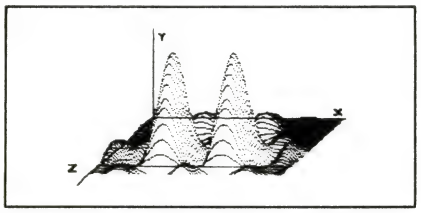
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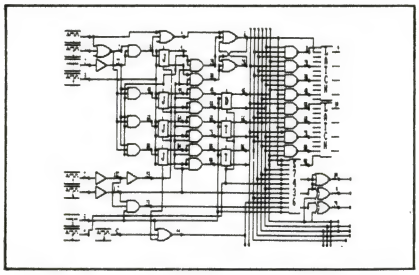
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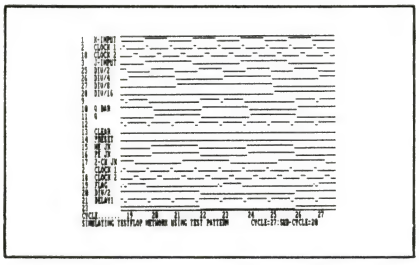
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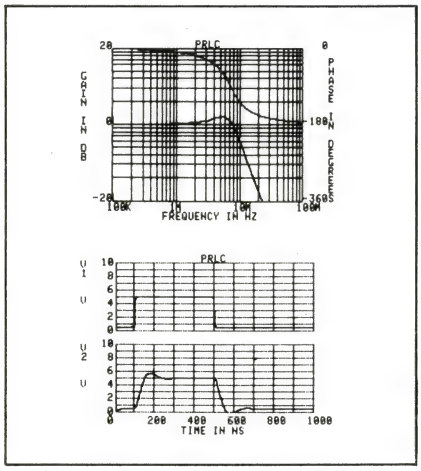
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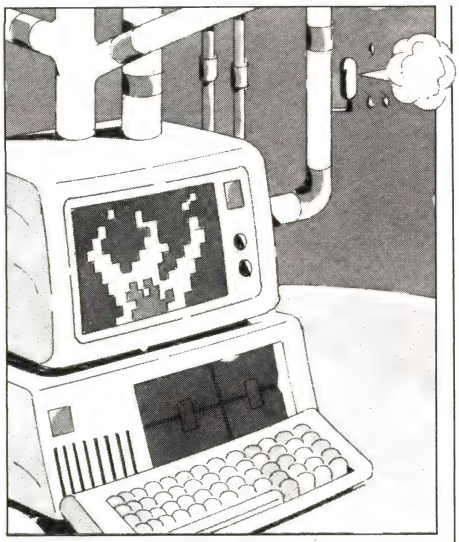
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I spent a lot of time this winter watching a thermometer in my house. I was trying to figure out how frequently the furnace kicked on to maintain a given room temperature. I finally gave up and went south for a vacation. When I came back, I had a program for the PC in my mailbox that will perform such energy calculations with the same scientific rigor as a professional who does this for a living—the HVAC engineer.

HVAC stands for heating, ventilation and air conditioning. For years, HVAC engineering was a quiet profession. But the business changed fast during the 1970s when energy prices zoomed into the stratosphere. Landlords struggled to pay the fuel bills of shivering tenants, and many states passed minimum energy efficiency standards for new buildings. As a result, HVAC engineers developed fairly sophisticated analyses of building thermodynamics and energy costs.



To use these analyses requires hours of detailed number crunching with variables such as the construction materials and methods, the building location, and the equipment that will be used to heat and cool it. Sounds like a perfect application for an IBM PC, doesn't it? A number of software vendors are already fulfilling this need. One of the best so far is MC2 Engineering Software, which supplies a family of HVAC programs for the IBM PC and other computers: *CL4M Commercial Cooling and Heating Loads—ASHRAE Method; RL5M Residential Cooling and Heating Load—Manual J Method;* and *EN4M Energy Analysis, Systems Simulation,* and *Economic Analysis*. Bob McClintock, president of the Miami-based MC2, says that his company offers a number of other programs for specialized building applications like airducts, sprinkler systems, or solar energy (flatplate) collectors, but that *CL4M, RL5M,* and *EN4M* are the basic programs you need to design a building or to optimize the energy consumption of an existing one.

McClintock has been in the software business for some 6 years. Formerly, he was with Carrier International Corporation, the air-conditioning equipment manufacturer. Parts of the MC2 programs were written by McClintock and the rest by specialists under contract to the company.

All three packages include interactive menu-driven programs with which you can obtain intermediate results. Parts of the programs are fully compiled, while other parts are written in BASICA. If needed, McClintock says he can either provide the source code or work with the user to adapt the program to his or her

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**List Price:** *RL5M,* $295; *CL4M* and *EN4M,* $995 each
**Requires:** *RL5M;* 64K RAM, one disk drive. *CL4M* and *EN4M;* 128K RAM, one double-sided disk drive.

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Illustration: Philip Anderson

special needs.

"We compiled parts of the program to increase speed," he says. "Run on a mainframe, the evaluations could be completed in a few minutes, while the typical runtime on a PC is about an hour." The menus do point out many shortcuts that can reduce runtime or the tedium of repetitive data entrys.

## RL5M

*CL4M* and *RL5M* both measure heating and cooling loads, but with vastly different tools. *RL5M,* which is for houses, is based on an analysis method developed by the Air Conditioning Contractors of America that is known as *Manual J.* (McClintock used the fifth edition from 1975 but he says a revised edition has since come out, and he is in the process of updating *RL5M* to comply with it.) You begin using *RL5M* by dividing the house into zones. It can handle up to 50 rooms, or a house treated as one room. You plug in data about the materials used in the house's construction, its orientation on the compass, and its dimensions. The program then calculates a variety of "heat transfer multipliers" for walls, windows, and roofs. It combines these multipliers with data on the geographical location of the building to obtain values for the needed amount of heating and cooling in terms of BTUs per hour per square foot. From these values an HVAC engineer can quickly calculate the size of furnace or air conditioner needed for the house.

McClintock says that *RL5M* is ideally suited to sizing equipment for a house or a condominium. Its limitation is the same as that of *Manual J.* Many of its standard heat-transfer values, which are taken from the tables in *Manual J,* don't tell enough about the true performance of building components. That issue, as well as many others, are addressed in *CL4M,* the commercial-building program.

## CL4M

*CL4M* takes a much more comprehensive approach to sizing building loads. It is based on analysis methods worked out by ASHRAE (the American Society of Heating, Refrigeration and Air Conditioning Engineers), as described in Chapters 22 to 23 and 25 to 26 of *ASHRAE Fundamentals* (1977), the National Bureau of Standards' NBSLD program, and the Carrier Corporation's *Handbook of Air Conditioning Design.* (Like *Manual J, ASHRAE Fundamentals* is available in a newer edition—1981. McClintock says he is hustling to get the changes from this newer edition into his programs.)

To use *CL4M,* you first enter the properties of the building you are designing. You label each room or building section as a particular zone and then key in the properties of that zone. But instead of simply entering dimensions, geography, and heat transfer multipliers as with *RL5M,* you must input everything but the kitchen sink: the materials and construction methods of the walls; the types of windows and window blinds or awnings; the dimensions of air space between the ceiling of one level and the floor of the one above; the amount and type of lighting; the amount of furniture and carpeting; and the number, type, and frequency of use of the doors.

CL4M and RL5M both measure heating and cooling loads, but with vastly different tools.

Did you know that female office workers generate only 85 percent of the heat of male office workers? Or that restaurant eaters generate more heat than a roomful of typists? The program calculates different load factors for these different building occupants.

The most important factor in determining how fast a building heats up or cools down is sunlight. The program has algorithms that allow you to calculate the sun's position during the year, how the sun's rays enter through the windows, and finally, how much heat this sunlight adds to a building.

The program does not, however, account for a 30-story skyscraper just south of the charming shoe factory you are converting into lofts. But as McClintock explains, you can get relatively accurate measurements with a simple trick. "Take the subroutine that calculates the shading on a window with a certain type of awning," he explains. "Then put in the dimensions of your building for the window, and the dimensions of the building next door as the awning, and the program will give you an average value for the shading during any particular time of the year." This value can then be coded into the program, and while it won't tell you what windows are in shade and which are in sunlight, it will tell you to what extent the heat transfer of your building's shaded wall is affected by the skyscraper.

A number of other values, such as the effects of heavy winds on the air leakage through a wall, are also not accounted for by the program, but McClintock says they are readily available from engineering handbooks and can be entered into the overall calculations.

"There are easily over 100 data points for each building zone in the program and there can be dozens of zones in a large building," notes McClintock. Keying all of these data points into the PC could take days, but he says the program permits a number of shortcuts. For instance, since many zones are similar or even identical, you can repeat all or most of the data points for one zone in another zone. You can also rotate a zone from, say, the north side of a building to the south, the subroutine for sunlight will automatically calculate the changed heat load. The whole building can be rotated as well.

Ultimately, the program calculates the maximum heating and cooling loads for a building. With these in hand, you can then size the air conditioning system and boilers as well as the ductwork leading to each

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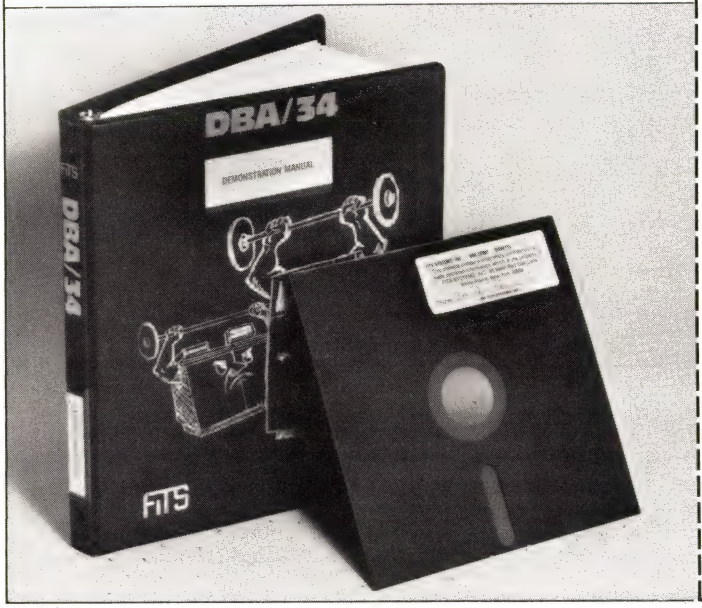
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zone. With *CL4M,* you can play around somewhat with alternative designs to see how, for instance, light-reflecting glass would aid in keeping the building cooler.

However, if you are looking for a more rigorous analysis of building energy economics, you should turn to MC2's third product, *EN4M.*

## EN4M

While *CL4M* calculates how hot or cool a building becomes, *EN4M* determines how best to meet those heating and cooling loads. Although best suited to existing buildings that are being examined for potential energy savings, it can also be used to see how new building design changes would affect energy costs.

In either case, you enter the temperatures at which the building will be kept, its geographic location, its existing or proposed HVAC system, and the cooling and heating loads on the building. As in *RL5M,* you break the building into zones for which the program calculates individual loads. A separate subprogram develops a weather profile for a year. After you run a baseline case to determine the operation of the HVAC system, another subprogram can perform an energy and cost analysis.

You can input up to seven proposed designs during one run. The program recomputes full energy and economic analysis for each design to see what the net cost effects are. It will tell you, for example, which is more cost effective: modernizing an existing boiler, or ripping it out and putting in a new one. It can handle much more complex problems as well, incorporating data from the weather profile.

*RL5M, CL4M,* and *EN4M*—include printing instructions that McClintock says can interface with commonly used printers. He also says that he offers program updates—for new types of computers or for new analysis methods—at the cost of the replacement disk and shipping.

These days, I'm back to watching my thermometer and enjoying the moderate temperatures of a New York spring. As I think about the approaching summer and the wheezings of my Model T air conditioner, I wish that my building's designer had had tools like these programs when my apartment was built. ■

*Nicholas Basta, who was trained as a chemical engineer, is a New York-based technical and business journalist.*


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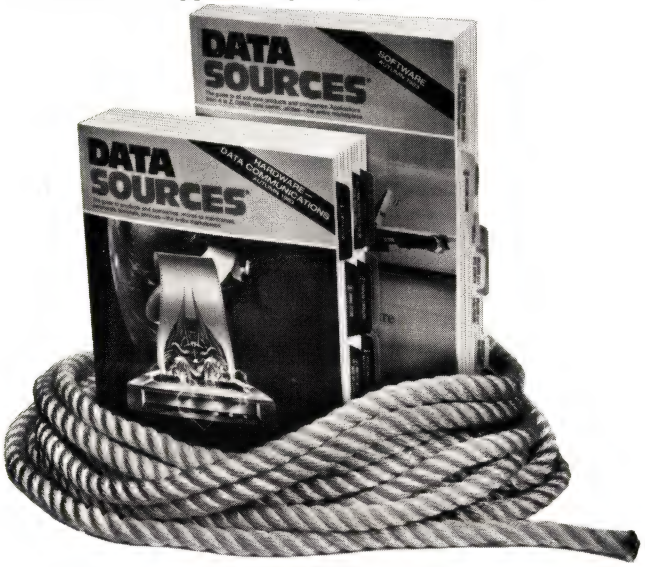
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# Well Schooled In 1-2-3

## Integrated software packages such as Lotus' 1-2-3 can enhance school management and offer administrators a powerful alternative to packaged educational-management software.

School administration tasks such as keeping track of student attendance; class lists; teacher assignments; grade computation; achievement-test results; budgets; and forecasting pupil, staff, and program changes easily lend themselves to commercially available software programs. One example of an integrated software program that can help school administrators carry out these tasks is *1-2-3* from Lotus Development Corporation, in Cambridge, Massachusetts. *1-2-3* provides spreadsheets, graphing, database management, and word processing—all using a single set of program commands.



Illustration: Michael Ng

Enrollment projections, a necessity for long-term planning, are derived from simple calculations using historical enrollment trends. Retention ratios developed from these calculations indicate the percentage of the pupils at one grade level who move on to the next grade level. Using *1-2-3*'s spreadsheet, district or school enrollment for grades kindergarten through 12 is entered for each of the past 5 years. Retention ratios are calculated between each successive grade for each of the 5 years. *1-2-3*'s AVG function provides an average retention ratio for all grades over the entire 5-year period. This average is then used to calculate future enrollment by grade level and year. *1-2-3*'s COPY command can save time with these calculations. After the calculations have been completed, a new section of the spreadsheet is used to construct a table of enrollment projections for the next 5 years. The projection table can be used again the following year merely by adding the most recent enrollment figures. Although setting up the table the first year requires spending a fair amount of time designing the enrollment projection model on the spreadsheet, future years require only minor additions of data.

### What If?

The "what-if" questions so popular with computer spreadsheet users are also useful for enrollment projections. If, for example, a school planner decides that increased housing construction will result in a retention ratio greater than the average of the past 5-years, the ratio can easily be changed in the model, which yields a new set of projections. A process that would have consumed days of manual planning time can now be accomplished in a few hours.

Staff and pupil planning can also benefit from *1-2-3*. Administrators typically begin thinking in May or June about the organization and structure of their schools for the next school year. How many class sections will be needed for next year? How many teachers? How many classrooms? Using *1-2-3* to help with these

issues can raise the quality of planning. It's easy to develop a "school classroom, section, and teacher" projection to enable administrators to answer these questions based on a number of different assumptions. For example, if the top administration and board of education of a district decide that class size must increase or decrease because of budget concerns or a reallocation of resources, obviously the number of class sections at all grade levels will have to change. *1-2-3* conveniently allows the school planner to see what would happen if class size is altered, and what the impact of such changes would be on the number of pupils in each class section.

The model developed with *1-2-3* calculates the number of students in a school, the number of classrooms available, the number of classrooms needed, and the average class size for the school. In addition, the model calculates the section size for each grade level based upon the projected grade-level enrollment. This calculation is accomplished by taking advantage of *1-2-3*'s powerful macro function. Alt-letter key combinations can be used to divide the number of students in a particular grade by the number of sections the administrators desire, resulting in a breakdown of pupils by section.

> 1-2-3 can be a powerful and flexible management tool for the school executive.

*1-2-3*'s database management component is more than adequate for the needs of the typical school executive. Attendance recordkeeping systems can be developed by entering student names and recording their attendance. From this simple database, a list of absentees can be generated on a daily or weekly basis. This rudimentary attendance system cannot compare with recently introduced school attendance systems that automatically generate letters to parents and maintain comprehensive records of absences and their reasons, but it costs much less than the $10,000 that those kinds of systems typically run.

### Database Management

School administrators can also use the database component of *1-2-3* to store pupil achievement-test information. Most



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schools use permanent record cards to maintain this information and store it away safely in a file cabinet. The information is generally not readily available to the administrator, and often it is not organized in ways that make it useful for instructional and program planning. Storing test information on a *1-2-3* file, on the other hand, allows you to easily query the database. All pupils with a below average score in reading or math, for example, can quickly be identified. In fact, using the *1-2-3* DATA/QUERY command, achievement-test data can be analyzed in any number of ways.

Mainframe computers are another traditional method of generating school achievement-test data. They are quite good at collecting the data, but notoriously bad at presenting it in a readable and understandable form. Although the computer-scoring divisions of major testing companies such as CTB/McGraw-Hill have spent a great deal of money and effort, teachers and parents continue to have difficulty with the test reports they provide. Some school districts have the facilities to score their own tests, but the packaged scoring programs they use generally do not lend themselves to locally designed reports. You can use *1-2-3* to design a special, individualized testing report complete with tables, charts, and graphs. After the test-report format is developed, principals merely update the report each year as new data become available. Principals can thus computerize their school's test data in a way that readily allows for a longitudinal assessment of a school's programs and its student's performance.

School administrators often have to create other kinds of presentations too, and *1-2-3*'s word processing function can help. Although the word processor in *1-2-3* is not sophisticated or powerful, it can hold its own for writing short documents. *WordStar* or another full-featured word processing program would be more appropriate for writing long test reports or creating annual reports that are sent to thousands of households, but *1-2-3* is convenient to use for brief explanations of a graph or chart in a report, or to write memorandums.

## Size Limitations

The school administrator working in a small school or district will realize the most benefit from *1-2-3*. The largest database you can construct with *1-2-3* on an IBM PC with 256K holds about 150 elements with 6 fields each. Although it is


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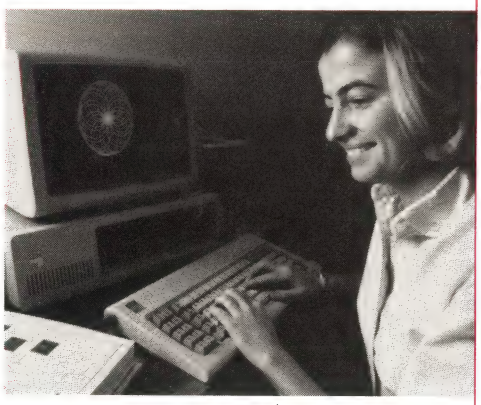
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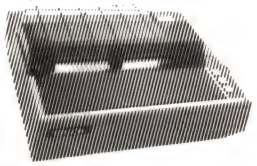
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*Edward Lynn is the Director of Special Projects at the Wappingers Central School District in Wappingers Falls, New York. He has been working for several years on adapting microcomputers to school administration tasks.*

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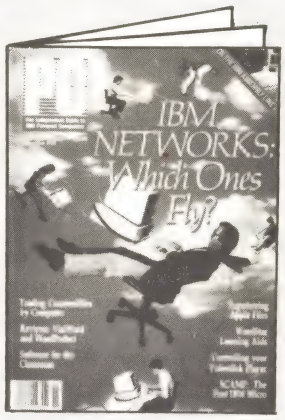
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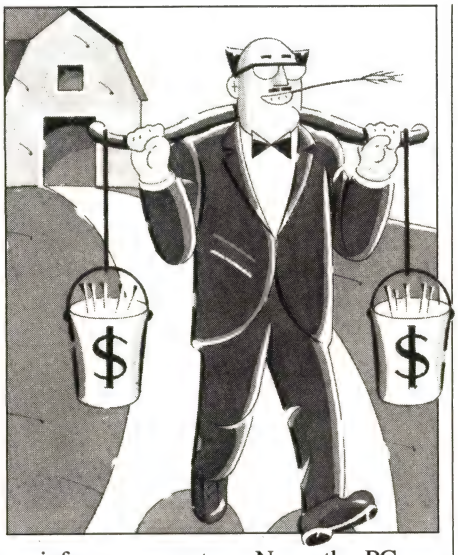
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# Milking the $ Cow

## Bank of America's sophisticated MicroStar package is carefully tailored to help the cash manager wring the last cent of investment interest out of bank and corporate megabucks.

Managing money for banks and large corporations entails considerable grunt work. Not only are treasury department cash managers responsible for squeezing every possible interest dollar out of the millions under their control, they are expected to do so with maximum efficiency and minimum risk. To maximize interest income they must keep track of numerous bank accounts scattered all over the country or the world, of a slew of short- and long-term investments, and of interest rates for a wide range of investment instruments.

Until recently, for their vital statistical information these cash managers depended on large data processing departments and centralized sources that accessed other mainframe computers. Now, the PC can help them make financial judgments without waiting in line to access a terminal and without incurring the substantial cost of time-sharing services.



With a PC and a complex spreadsheet and communications package called *MicroStar,* what was once a labor- and time-intensive operation that required platoons of clerks can now become the work of one person.

The giant California-based Bank of America designed *MicroStar* for its own use, but now sells it to other organizations that must handle millions of dollars.

The package breaks the key components of cash management into workable chunks and translates them into a series of procedures performed on a PC.

The *MicroStar* system was developed for Bank of America's internal use, according to Jeanette Whittemore, marketing manager for the system. "There are numerous standards in the banking industry, and the software was developed around them. We spent a great deal of time working all the kinks out of the product. Once we had it up and running we realized we had a generic tool that managers could benefit from."

"A lot of what the PC does now was once done on paper," says Chris Winter, the bank's vice president of treasury department services. "Imagine the amount of work that was involved in transferring the details of 20 corporate bank accounts from one set of ledgers to another. The PC frees managers for higher level functions, like selecting the day's best investments."

### Interlocking Modules

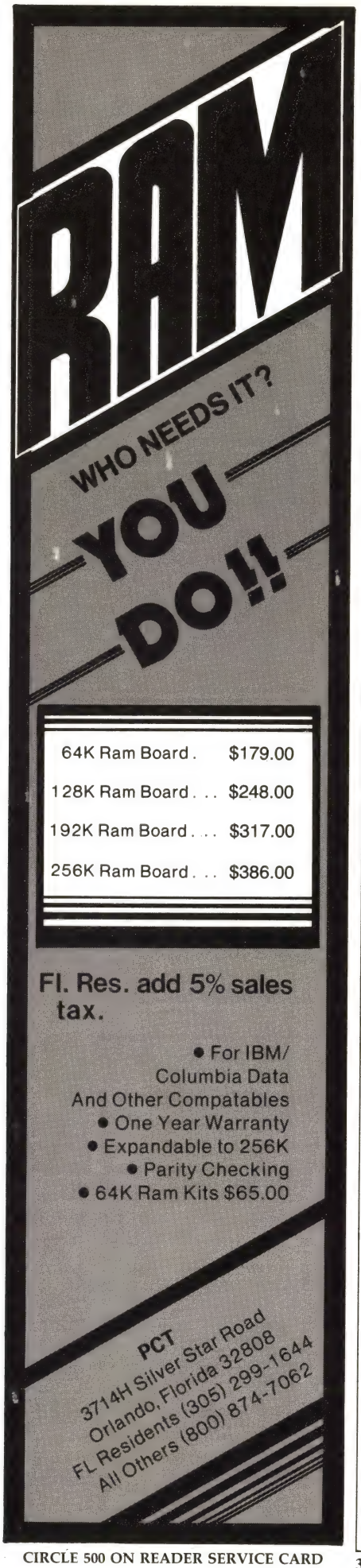
*MicroStar* is composed of interlocking modules, each designed to handle a major cash management job function or help sort and organize data. The six different core modules read and write data to one another. They are:

- *MicroPlan,* Chang Laboratories's sophisticated spreadsheet program;
- A daily cash projection worksheet that

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San Francisco, CA 93137
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Illustration: Philip Anderson



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helps organize data for projections;
- A daily transaction journal for posting transactions;
- A consolidated balance report, for pooling the day's entries;
- A communications program, which includes auto-dial and automatic call-up software that obtains account and other data from bank and other outside databases;
- A menu processor, which connects all these options and creates a series of menus and submenus for accessing them.

More than just the sum of its modules, *MicroStar* also includes *WordStar,* for writing reports, and a ready-made database format written in *dBASE II* that holds the account and investment information used for daily cash management decision-making. All of its parts are completely integrated and have many banking industry standards, codes, and communications protocols built into them. More importantly, the logical sequence of tasks a cash manager or treasurer performs each day is also built in.

For example, a corporate treasurer might need to report the earnings of half-a-dozen company divisions, each of which has five or more separate bank accounts. These 30 accounts might be anywhere in the United States. The treasurer must know the balance in each of these accounts today, make an accurate forecast for tomorrow, and make projections for the next 3 months so that the company can take advantage of such different investment vehicles as tax exempt bonds, commodities, and short-term loans.

## Daily Routine

Thus, rather than a main menu that lists the core modules, the user is presented with a main menu that follows a cash manager's five-step daily routine. It offers the following choices:

1. Communications (for collecting and printing account balance data);
2. Account Data Entry (for keying in balance data not automatically entered by *MicroStar*);
3. Daily Processing (for posting data to today's worksheets);
4. Daily Processing, Optional (for updating worksheets later in the day, as necessary);
5. End of Day Processing (for filing worksheets and preparing for the next day).

**The giant California-based Bank of America designed MicroStar for its own use but now sells it to other organizations that must handle millions of dollars.**

The user chooses an option by number, which leads to another menu, a submenu, a worksheet, or a processing operation.

Under the communications option, *MicroStar*'s auto-dial feature eliminates the tedious job of dialing different bank time-sharing systems to accumulate the day's account information. It stores all dial-up instructions and automatically conducts terminal sessions to the user's specifications. *MicroStar* can be left unattended to make its calls during the night when phone rates are lowest and can have the collected data available when the treasurer arrives in the morning.

All account data that *MicroStar* receives in BAMTRAC, the Bank of America's system format, or from banks that are members of National Data Corporation, is entered automatically. Non-BAMTRAC account data is printed out so that it can be manually entered using the Account Data Entry option. The program converts this manually keyed data to the BAMTRAC format for posting to all appropriate worksheets.

Under the Daily Processing option

*MicroStar* includes a number of templates and worksheets. Templates are customized sets of headings, rows, and columns for a spreadsheet combined with a programmed set of instructions. Usually they are created once and left unchanged for long periods of time.

Worksheets function like scratchpads on which cash managers arrange and rearrange data to suit their needs. For example, a Target Balance worksheet can be used for monitoring cash position and managing bank relationships. The template remains unchanged and ready to be recalled, while the worksheet is the daily electronic scratch sheet, financial forecast, and model.

> A cash manager now has more latitude to take risks and get more attention from upper management.

Under the Daily Processing option, a submenu offers six categories: 1. Target Balance; 2. Daily Cash—Summary; 3. Daily Cash—Detail; 4. Consolidated Balance; 5. Intracompany Funds Flow—Detail; and 6. Intracompany Funds Flow—Summary.

The user copies the template for each category to use as a worksheet. Throughout the day, information is collected from various companies and banks, and the different worksheets are updated.

Under the End of Day Processing option, the user resets the communications files for tomorrow's automatic calls, moves the day's balance information into a history file, copies worksheets to a diskette, and recopies the templates for tomorrow's postings. The cash manager finishes the day's routine by putting *MicroStar* in its Unattended Automatic Calling mode.

Delegating this enormous mountain of detail to *MicroStar* gives the cash manager more time and information with which to review the projections of receipts and disbursements and decide how best to use the day's available funds.

### Industry Changes

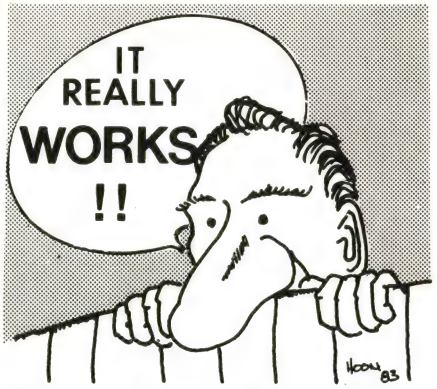
Marketing manager Whittemore believes that there has been a shift in the job definition of the cash manager in treasury departments. What was once just a tedious job has now become a "growth" position. A cash manager now has latitude to take risks, gets more attention from upper management, and is more likely to be promoted up the corporate ladder.

Training such high-level decision makers is increasingly important. Bank of America packages *MicroStar* with a support contract and a 5-day training session that teaches cash managers to use both the PC and the program.

"The 5 days of training are rugged," says Chris Winter, "particularly for managers who have never touched a PC. They tell us after it's all over that they've been through an ordeal: we throw an awful lot of information at them in that week."

Lauryn Franzoni, managing editor of *Electronic Funds Transfer*, the cash management industry's trade newsletter, says: "Banks are really taking to PCs and saving on time-sharing costs, which can easily amount to $3,000 per month for each cash manager's use. That kind of savings pays for an XT, the training, the customized applications programs, and the support."

Bank of America's *MicroStar* is one more indicator of the financial community's new philosophy. Once the staid guardians of long-term deposits, banks such as Bank of America are now exploring new and fertile marketing ground with entrepreneurial zeal. Taking a cue from more established software marketers, Bank of America even has a toll-free telephone number for its customers' use. And, if all else fails, a human being will be dispatched from the bank to steer customers through a crisis. ■


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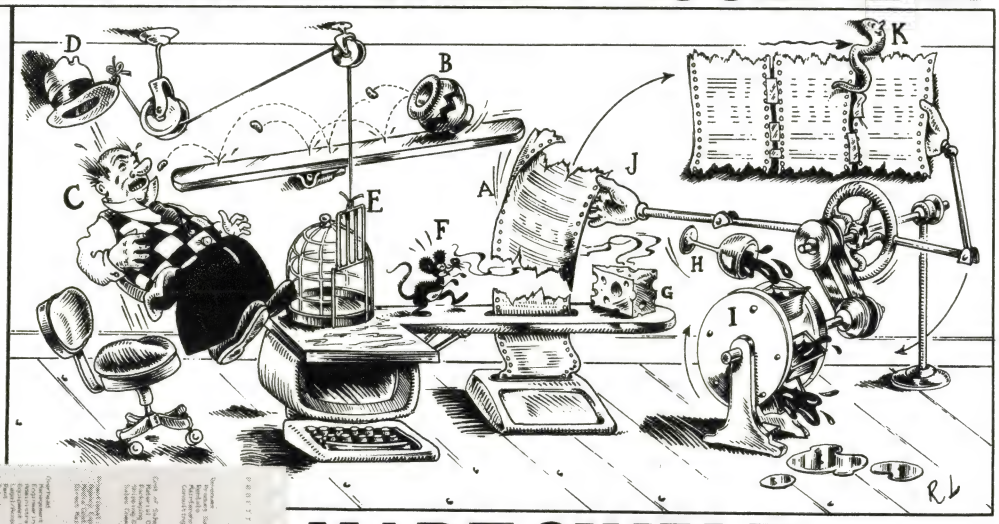
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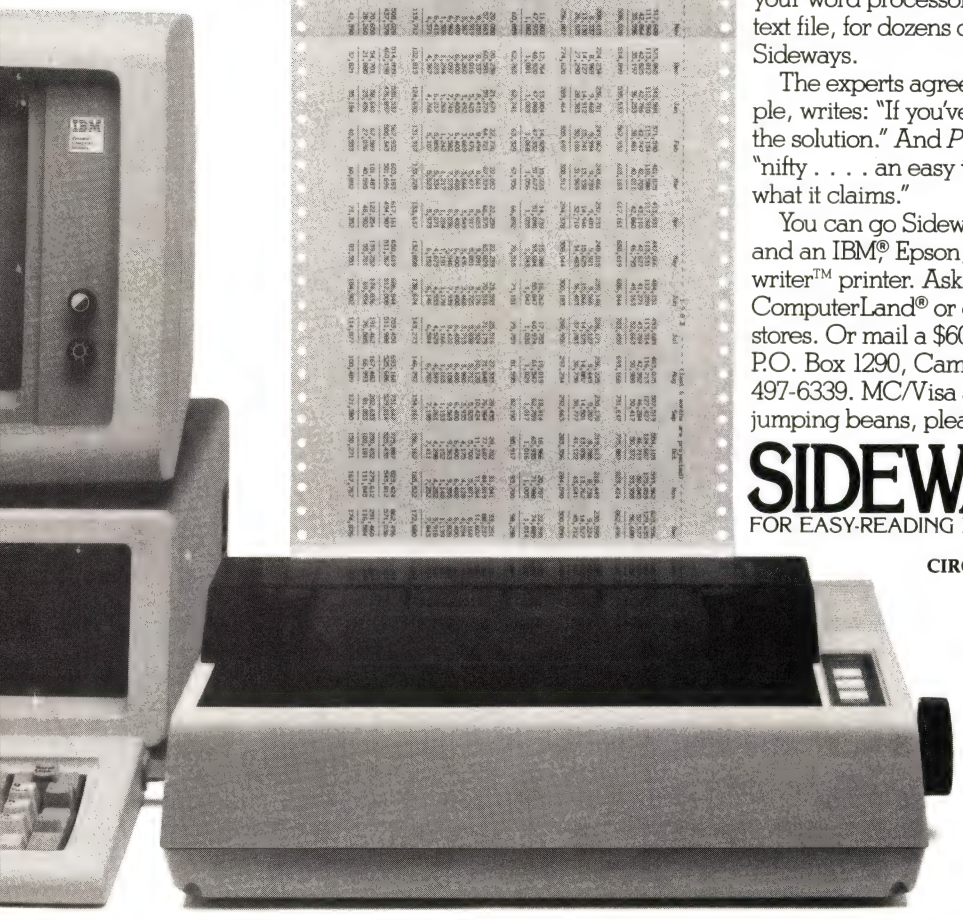
RISING SPREADSHEET (A) KNOCKS MEXICAN JUMPING BEANS (B) INTO MOUTH OF NEUROTIC MAN (C) WHO IS SO DISCOMBOBULATED THAT HIS HAIR STANDS ON END, DISLODGING HAT (D) WHICH OPENS CAGE (E) AND RELEASES EPICUREAN MOUSE (F).

MOUSE, INSPIRED BY SCENT OF PERFECTLY AGED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET, ONLY TO DISCOVER HE HAS BEEN FOOLED BY AROMA OF OVER-RIPE GORGONZOLA (G).

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# New On The Market

## HARDWARE

### Frame Editor

A hardware/software graphics package, intended for use with a digitizing tablet or optical mouse and a Verticom 200 graphics monitor. The package is designed to use an IBM PC's systems unit as its CPU, to which is added the Verticom hardware. The software allows the user to create free-form graphics designs utilizing squares, circles, rectangles, and other geometric forms, and makes use of up to 16 simultaneous colors chosen from a palette of 4096.

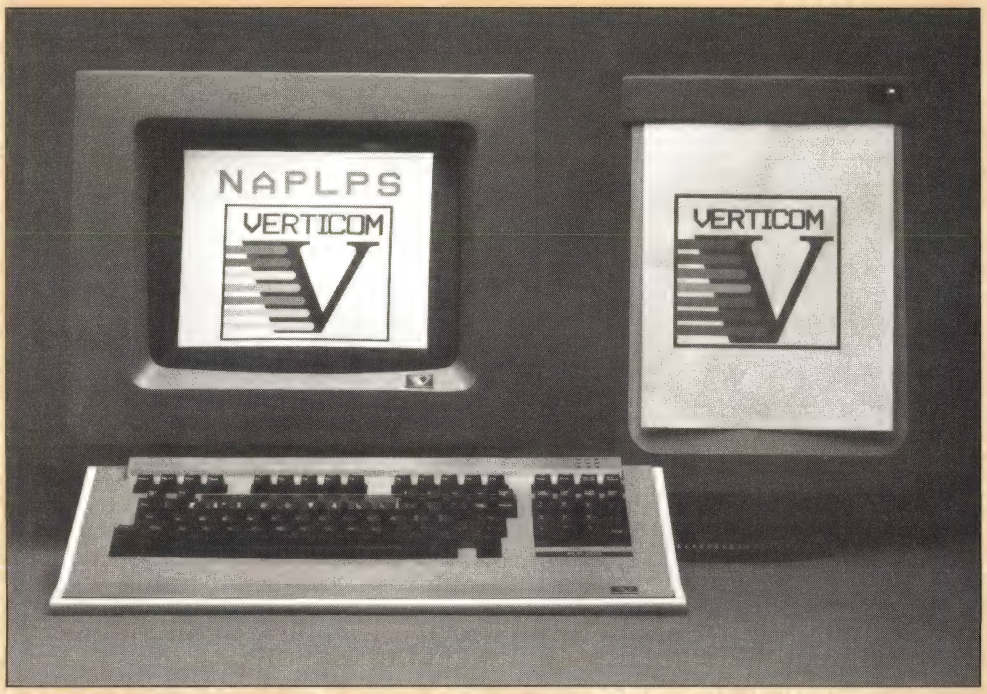
*Frame Editor* is compatible with the North American Presentation-Level Protocol Syntax (NAPLPS) standard, designed to mix graphics and text in an efficient, hardware-independent format.

*(List Price: With Verticom 200 Terminal, Digitizing Tablet or Optical Mouse $7,450)*

**Requires:** 128K RAM, one disk drive, PC-DOS.

*Verticom Inc.*
*545 Weddell Dr.*
*Sunnyvale, CA 94089*
*(408) 747-1222*

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***Frame Editor,*** *Verticom Inc.*

### Interface DiskSystems

A line of Winchester 5¼-inch hard disks, consisting of nine models with formatted storage capacities of 10.6, 15.9, and 25.1 megabytes. There are models for use as central storage devices, or as system slaves, in external or internal use configurations.

All of the DiskSystem units feature a track-to-track access time of 2 milliseconds. The 10- and 15-megabyte units have an average access time of 85 milliseconds, with the 25-megabyte offering an average access time of 54 milliseconds.

Each DiskSystem drive includes an IBM-compatible controller (if required), standalone cabinet or internal mounting hardware, cable, power supply, connectors, and I/O adapter.

*(List Price: Main Storage Models: 10MB $1,495; 15MB $1,795; 25MB $2,295; Slave Models: 10MB $1,185; 15MB $1,385; 25MB $1,985)*
*Interface Inc.*
*7630 Alabama Ave.*
*Canoga Park, CA 91304*
*(213) 341-7914*

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### M68000 Single Board Computer

A hardware/software package that interfaces with the user's system, allowing the user to develop and debug programs for systems incorporating an M68000 microprocessor. The hardware consists of a standalone single board computer (SBC) equipped with a 6MHz or 10MHz M68000 CPU, 20K of RAM, 16K of EPROM space, two RS-232 ports, a 16-bit parallel port, five 16-bit counter-timers, and an expansion bus to allow for memory and I/O expansion.

The included software consists of the M68KXAS Macro Cross Assembler, which can assemble source files created by the user's system into code acceptable to the M68000 microprocessor, using standard M68000 mnemonics. The object file generated by the assembler is formatted to allow downloading from the user's system to the development system.

The M68000 IC chip on the single-board CPU supervises the downloading operation, which is performed using one of the RS-232 ports. Once downloaded, the user's program under development can be tested and debugged, and the corrected program saved back to the user's system.
*(List Price: 6MHz $795)*
*Educational Microcomputer Systems*
*P.O. Box 16115*
*Irvine, CA 92713*
*(714) 553-0133*

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## UltraPAK

A multifunction plug-in board offering enhanced graphics capabilities, a parallel port, one or two serial ports, and a clock/calendar with battery backup. Additional options include an IBM disk controller, with or without 256K RAM; 384K of added RAM with an electronically emulated disk drive; and a choice of IBM color graphics or high resolution (640 × 400 dot) graphics in 16 simultaneously displayable colors.
*(List Price: $795)*
*Tseng Laboratories, Inc.*
*P.O. Box 566*
*Newtown, PA 18940*
*(215) 968-0502*

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## IDS 6240 Modem

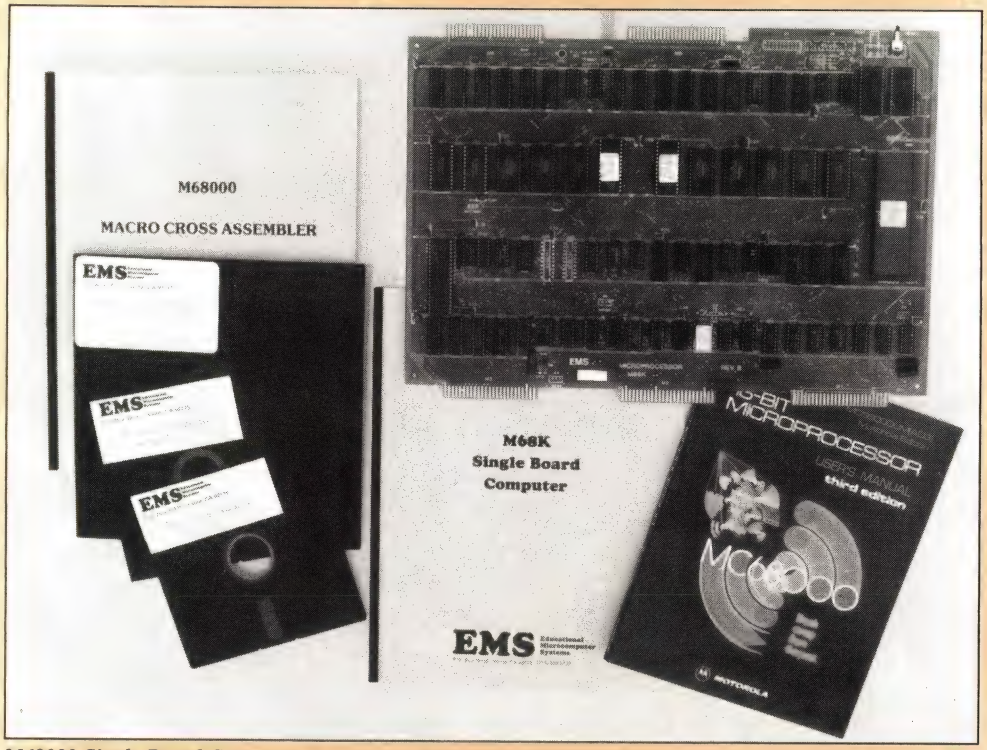
A limited-distance modem, designed to permit network communications over 2- or 4-wire loaded or non-loaded twisted pair networks. It can be used in both point-to-point or multidrop network configurations, and is specially designed for "short haul" data transmission.

The model 6240 limited-distance modem provides asynchronous operation at data rates of up to 4800 baud over loaded lines, and up to 9600 baud over non-loaded lines. Two strap-selectable transmit levels meet AT&T 43401 and 41004 specifications. Other features include analog loopback, remote digital loopback, transmit pattern, and the ability to inject deliberate errors to provide verification of a network's performance. Six LEDs monitor the status of key interface signals and the digital loopback. A lockout feature protects the loss of synchronization between the network's master system and remotes.
*(List Price: $400)*
*International Data Sciences, Inc.*
*7 Wellington Rd.*
*Lincoln, RI 02865*
*(800) IDS-DATA*
*(401) 333-6200*

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## ST3703 Network Processor

A unit permitting up to 12 separate personal computers, terminals, or other serial line devices to be linked to a mainframe system using IBM's System Network Architecture (SNA) protocol. Other networking protocols supported by the ST3703 Processor include the Amdahl, Natsemi, and Facom systems. The networking device features a dynamic protocol processor (providing a hardware-independent channel of communications with the mainframe system as a Physical Unit Type 2), coupled with a host support program and downline mul-




***M68000 Single Board Computer,*** *Educational Microcomputer Systems*

ti-function capability.
*(List Price: unavailable at press time)*
*Systems Technology Pty., Ltd.*
*Office of the Australian Trade Commissioner*
*636 Fifth Ave.*
*New York, NY 10111*

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## V1000 Voice Response System

A device permitting the user's system to respond vocally to queries made over phone lines, and to make vocal outgoing calls to a user at a remote location. The device can provide up to eight communications channels for voice or data transfers that can be configured under software control. Available options include a choice of a 300-baud Bell 103-compatible or 1200-baud 202-compatible modem, GPIB (IEEE 488) support, or IBM 3270 support.

The V1000's voice response capability is based on adaptive differential pulse code modulation, which gives the device a virtually unlimited, user-defined vocabulary. Optionally available is a preprogrammed vocabulary library of 1,300 words, developed using linear predictive coding voice-synthesis techniques. A user at a remote location can query the system, make updates to a database, modify a program flow, etc., using Touch-Tone code signals from a standard Touch-Tone phone.



***V1000 Voice Response System,*** *Vynet Corp.*

Packaged in an enclosure having the same overall dimensions as the IBM PC's systems unit, the V1000 can be stacked with the user's system for a compact arrangement. The device connects to the user's system via a ribbon cable that plugs into a single expansion slot. A 256K RAM expansion option is available to hold additional speech or program data for very large applications.
*(List Price: 8-channel unit $7,315)*
*Vynet Corp.*
*160B Albright Way*
*Los Gatos, CA 95050*
*(800) 538-7002*
*(408) 370-9764*
*(408) 370-0555*

CIRCLE 748 ON READER SERVICE CARD

## ASCI AMI Port Switches

A line of switching devices allowing from eight to 32 RS-232 data lines to transmit to one RS-232 output port. The devices are intended for use in applications where it is necessary for a number of sources to input data to a single monitoring CPU.

Because the ASCI AMI units simultaneously monitor all input lines, each device linked to the switching center can control the output port as needed, without requiring the CPU to continuously poll every input device linked to it. Transmission is bidirectional, and baud rates from 150 to 19,200 are supported.
*(List Price: $1,843 to $4,395, depending upon number of ports)*
*Advanced Systems Concepts, Inc.*
*435 N. Lake Ave.*
*Pasadena, CA 91101*
*(213) 793-8971*

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## Turbo Stick

A joystick offering high pointing and cursor-repositioning speed, high resolution, and full RS-232 ASCII output for simplified interfacing with the user's system. The handle of the Turbo Stick incorporates two fingertip-activated microswitches that allow the user to switch between an absolute mode with high pointing speed, and a rate mode with high resolution. The switches can also be redefined under software control.
*(List Price: $395)*
*KA Design Group*
*6300 Telegraph Ave.*
*Oakland, CA 94609*
*(415) 654-6300*

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## IDEAdisks

A line of 3.9-inch Winchester hard disks, available in formatted storage capacities from 5 megabytes to 40 megabytes. The line includes both internally- and externally-mounted units, in

fixed or fixed/removable cartridge configurations. Externally mounted units include a separate power supply in an enclosure designed to complement the user's system.

The IDEAdisk line includes the following models: 10MB internal, designed to fit the space of a full-height floppy drive; two 5MB fixed external units, with or without a removable 5MB cartridge; two 10MB fixed standalone units, with or without a 5MB cartridge; two 20MB fixed standalones, with or without a 5MB cartridge; and two 40MB fixed standalones, with or without a 5MB cartridge backup. Each IDEAdisk unit includes interface, as well as support software and mounting hardware.
*(List Price: $1,495 to $5,295, depending upon storage capacity and configuration)*
*IDE Associates Inc.*
*7 Oak Park Dr.*
*Bedford, MA 01730*
*(617) 275-4430*
*Telex:94 8245*

CIRCLE 741 ON READER SERVICE CARD

## PCterminal

A disk-less intelligent terminal that can be used in place of a standard IBM PC in a PCnet local area network application. The terminal has a monitor, keyboard, an 8088 microprocessor, both a serial and a parallel port, four expansion slots for peripheral boards, 64K of RAM (expandable to 256K), built-in networking capabilities, and a connector for an optional 5¼-inch floppy disk drive. The optional disk drive permits the PCterminal to run programs locally as well as over the network.

PCterminal operates under both PC-DOS and a proprietary operating system, SCS-DOS. A special PCnet protocol permits the terminal's operating system to be initialized from another PC on the network, and to communicate over the network without a disk drive. PCterminal incorporates all necessary PCnet hardware, and includes a remote execution feature permitting the terminal to run a command on another system linked to PCnet as if the command had been entered on the other system's own keyboard.
*(List Price: $1,295)*
**Requires:** PCnet Local Area Network.
*Santa Clara Systems, Inc.*
*1860 Hartog Dr.*
*San Jose, CA 95131*
*(408) 287-4640*

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***IDEAdisks,** IDE Associates Inc.*




***PCterminal,** Santa Clara Systems, Inc.*

## Model 430 Mini Drivers

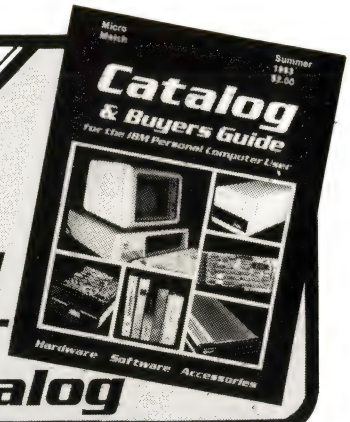
A device for transmitting data over limited distances using two twisted-pair wire cables. The devices, small enough to hold in the palm of one's hand, operate asynchronously over full-duplex, four-wire circuits at speeds of up to 19,200 baud at a distance of over one mile. Transmission distances increase to up to 18 miles at 110 baud (depending on specific operating conditions and wire thicknesses).

The Mini Drivers plug directly into an RS-232 port in the user's system, and do not require additional power supplies or special configuration procedures. The drivers are packaged in cartons

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**AST RESEARCH**
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**MEGAPLUS II** — Expands to 512K with 256 MEGAPAK or to 384K with 128K MEGAPAK. Includes CLOCK/CAL & 1 SERIAL PORT.
W/64K ..... **265.00**
W/256K ..... **430.00**
256K MEGAPAK ..... **275.00**
128K MEGAPAK ..... **199.00**
OPTIONAL 2nd SERIAL PORT ..... **40.00**
OPTIONAL PARALLEL PORT ..... **40.00**
OPTIONAL GAME PORT ..... **40.00**
**COMBOPLUS** expands to 256K, includes CLOCK, PARALLEL & SERIAL ports.
W/64K ..... **265.00**
W/256K ..... **430.00**
**I/O PLUS II** — I/O only (no memory). Includes CLOCK & 1 SERIAL port.
I/O PLUS II ..... **120.00**
OPTIONAL 2nd SERIAL PORT ..... **40.00**
OPTIONAL PARALLEL PORT ..... **40.00**
OPTIONAL GAME PORT ..... **40.00**
**SIX PACK PLUS** — expands to 384K, includes CLOCK, PARALLEL & 1 SERIAL port.
W/64K ..... **265.00**
W/384K ..... **549.00**
OPTIONAL GAME PORT ..... **40.00**

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QUADBOARD I W/64K ..... **275.00**
QUADBOARD I W/256K ..... **430.00**
**QUADBOARD II** — expands to 256K & includes 2 SERIAL ports & CLOCK/CAL.
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QUADBOARD II W/256K ..... **430.00**

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CIRCLE 749 ON READER SERVICE CARD

## Telex Manager

A general-purpose telex interface allowing the user to communicate with telex terminals worldwide. The unit is designed to be simple to use, using message entry procedures that do not require knowledge of telex protocols. The Telex Manager automatically dials telex lines, checks received answerback, transmits stored messages, and rechecks answerback at the end of transmission. It retries when call set-up fails and when a service signal is received, and can automatically answer incoming calls, routing messages to the user's system, printer, or specified machine within a network.

The Telex Manager also permits the user to return to DOS and run any application while the device continues to operate unattended in a background mode. Telex messages can be created using either the device's built-in text editor or with any word processing program.

Other features of the telex device include an automatic log of all incoming and outgoing messages; a directory of frequently called telex numbers, which can be referenced with simple abbreviations; timed transmissions, which can take advantage of periods when rates are low and lines unengaged; and automatic receipt and acknowledgement of incoming messages, which can be either immediately displayed or stored to disk for later review.
*(List Price: $1,695)*
**Requires:** 128K RAM, one RS-232 line, one or two telex lines.
*Braid Communications*
*441 Pacific Ave.*
*San Francisco, CA 94133*
*(415) 398-7324*
*Telex: 17 6656*

CIRCLE 746 ON READER SERVICE CARD




***Telex Manager,** Braid Communications*

## Accelerator PC

A 10 MHz, 8086 coprocessor board available with from 128K to 640K of RAM. The board supercedes the 8088 microprocessor in the user's system, providing a clock cycle twice as fast as that used by IBM. This typically provides operating and processing speeds two to four times faster than normally available from IBM. When desired, the Accelerator PC board can be set to function at IBM-normal speeds.

Options available for the Accelerator PC board include modular "piggyback" boards offering additional RAM in increments of 128K. The board is also designed to accept the 8087 arithmetic processing chip.

Bundled with the Accelerator PC board is *Pseudo-Disk* software, which can speed access to a user's stored data, and a print spooling utility.
*(List Price: 128K $995)*
*Titan Technologies, Inc.*
*310 W. Ann St.*
*Ann Arbor, MI 48104*
*(313) 662-8542*

CIRCLE 752 ON READER SERVICE CARD

## StorageMaster 409

This is a replacement 5¼-inch floppy disk drive compatible with the PC. The full-height drive can store 320K bytes on a diskette (360K bytes per diskette for systems running under PC-DOS 2.0), and can be installed easily within the systems unit enclosure.

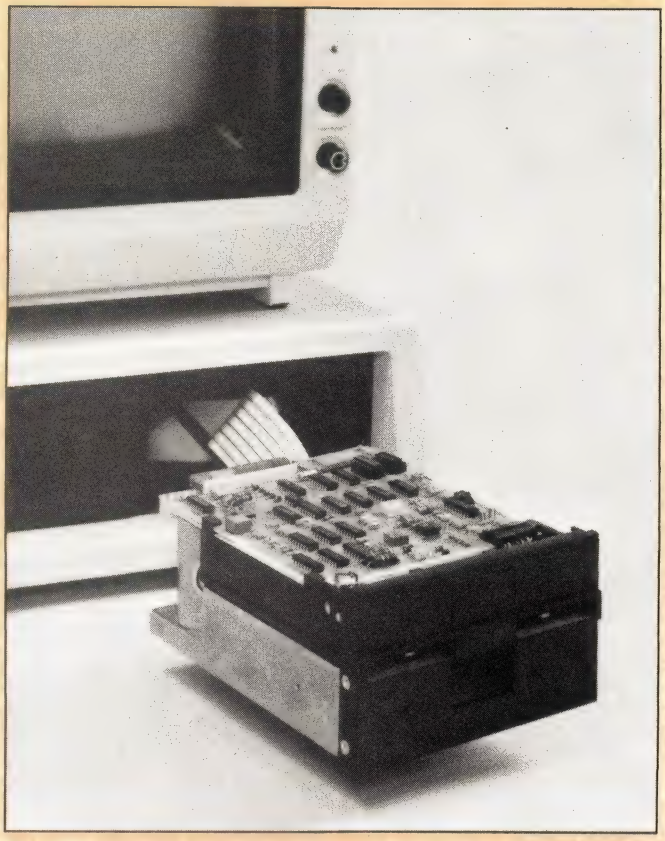
The StorageMaster 409 features long-life ceramic heads, and specifications which include an 80-millisecond average access time, a 250K bits per second transfer rate, and minimal preventive maintenance requirements. The drive meets or exceeds standards for auxiliary storage set by IBM.

*(List Price: approx. $435 to $530)*
*Control Data Corp.*
*Micro Peripherals (PLY027)*
*220 Berkshire Ln.*
*Plymouth, MN 55441*
*(612) 553-4653*

CIRCLE 751 ON READER SERVICE CARD

## MFX-100 Floppy Drive Analyzer

A microprocessor-based floppy drive analyzer that can perform mechanical and electronic test functions and calibration measurements without an accessory oscilloscope. The device is designed to work with all major disk drives, and can be used by non-technical personnel to perform in-store service, field service, depot repair, and production floor testing.



*StorageMaster 409, Control Data Corp.*

Calibration accuracy is provided by a crystal-based oscillator, with test results, measurement values, and test program runs shown on the unit's alphanumeric display. Operations that can be performed without an oscilloscope include head radial alignment, azimuth testing, head amplitude test, drive speed (index period) adjustment, index-to-data alignment, write-protect switch adjustment, and track zero sensor adjustment.

The MFX-500 provides total drive testing by means of its full step, write data, and read data capabilities, which include margin testing. The formatting/verifying of diskettes in the IBM standard format is a standard feature of the unit.

*(List Price: $2,495)*
*Wilson Laboratories, Inc.*
*2237 N. Bavaria St.*
*Orange, CA 92665*
*(714) 998-1980*
*Telex: 18 1598*

CIRCLE 744 ON READER SERVICE CARD

# SOFTWARE

## The English Machine

An artificial intelligence starter kit that allows non-technical users to operate BASIC programs in plain English. The software reduces the need for user training, as it employs a number of artificial intelligence techniques to communicate with the user.

*The English Machine* allows the user to reach up to 40 BASIC subroutines using a vocabulary of up to 150 words. It has a dynamic grammatical structure, permitting the user to change the interactive interface without changing the underlying codes.

*(List Price: $119.95)*
**Requires:** 64K RAM (PC-DOS 1.1); 96K RAM (PC-DOS 2.0); one disk drive.
*Babbage and Lovelace*
*1955 Bel-Air Dr.*
*Ottawa, Ontario*
*K2C 0X1 Canada*
*(613) 225-2656*

CIRCLE 728 ON READER SERVICE CARD

## PC-Draw, Version 1.3

An interactive drawing program that enables the user to create, maintain, and print all types of drawings. The program can be used to produce flowcharts, organizational charts, forms design, layouts, architectural, mechanical and electrical

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CIRCLE 354 ON READER SERVICE CARD

# Take Your Computer's Commands And Put Them Where They Belong. On Your Keyboard.

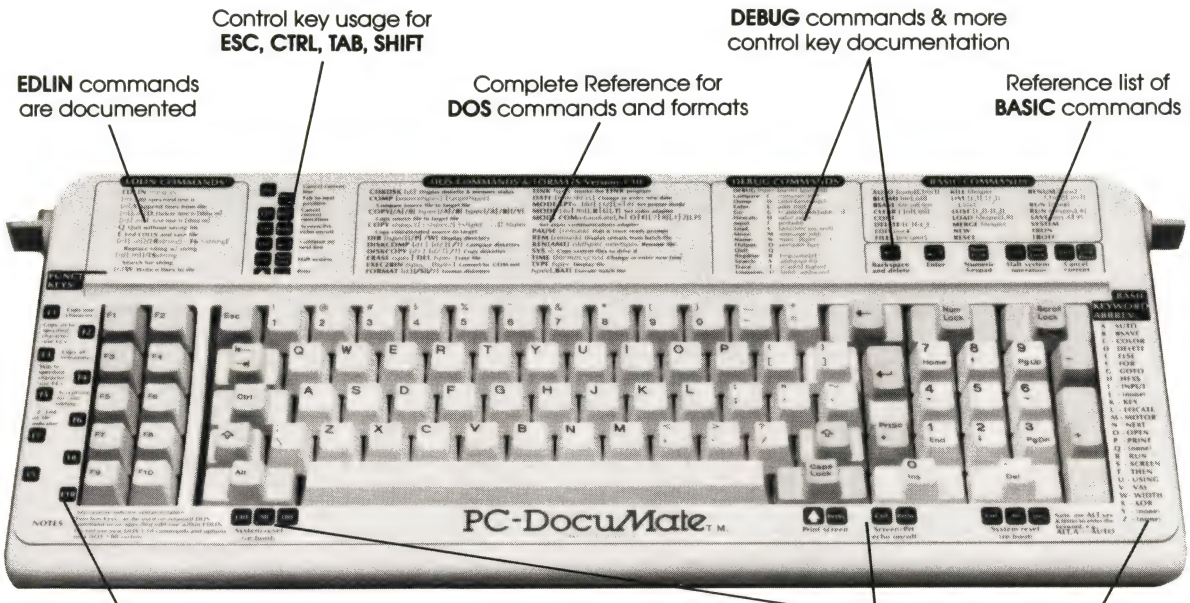
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Raleigh, N. C. 27619

CIRCLE 441 ON READER SERVICE CARD

design, and other drawing applications, by using predefined and user-defined symbol menus. The system supports use of a lightpen to minimize keyboard entry.

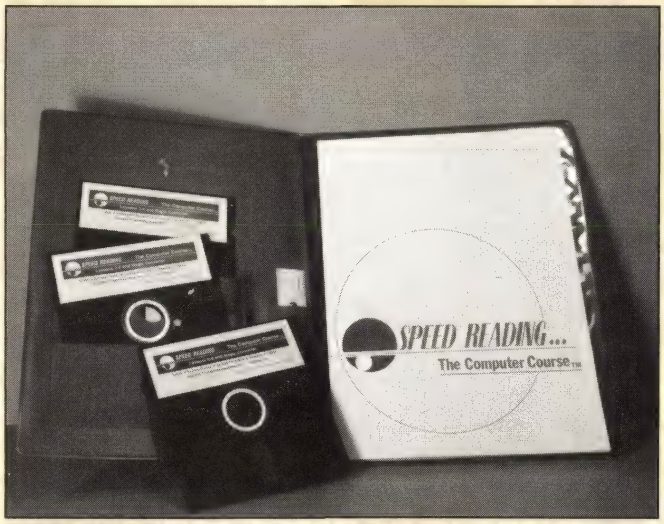
The new 1.3 version adds color support, presentation graphics, and a color overlay capability. Additional features of the system include improved user prompts for parameter entry, improved symbol scaling, simplified symbol manipulation between pages of a multi-page drawing, and an improved alternate text mode.

Support for the HP7470A Plotter is available as a separate module for users desiring plotter support.
*(List Price: CP-Draw Software, $250: Ver.1.3 upgrade charge, $50: HP7470A Plotter, $50)*
**Requires:** 128K RAM, two disk drives, PC-DOS, color/graphics adapter, compatible printer.
*Micrografx*
*1701 N. Greenville*
*Richardson, TX 75081*
*(214) 343-4338*

CIRCLE 727 ON READER SERVICE CARD

## MetaMenu

An interactive menu and help facility that provides on-screen instruction for all PC-DOS 1.1 and 2.0 commands. A built-in full-screen editor allows the user to modify the given menus of help information, or to create entirely new menus.



***SPEED READING . . . The Computer Course***

The program can be automatically called up from AUTOEXEC.BAT. Two operational modes are used, a Command mode and a Menu mode. In Command mode, the user enters the name of the command for which information is needed. The software then displays a short, one-line summary of the command at the top of the screen. The command name is automatically entered and, if there are no additional input requirements, it is automatically executed.

In Menu mode, the list of commands is displayed on the screen. The user selects a command by moving a highlighted area using the cursor control keys. Once a command has been selected, the menu disappears, and the command description is highlighted at the top of the screen. As with the Command mode, the command will then be automatically executed.

Menus can be modified or new menus added to the program, using the software's built-in editor. Menus include all *MetaMenu* commands, help for all PC-DOS commands, a user's manual, and a quick reference manual on the diskette.
*(List Price: $40)*
**Requires:** 64K RAM, one disk drive, PC-DOS.
*R. Williams*
*1470 Farnsworth Ave.*
*Ottawa, Ontario*
*K1H 7C3 Canada*

CIRCLE 726 ON READER SERVICE CARD

## SPEED READING . . . The Computer Course

An interactive tutorial program on speed-reading techniques consisting of eight half-hour lessons. The software is designed to double the user's reading speed. Moving from lesson to lesson, the software provides an understanding of speed-reading theory and basic techniques while imparting these skills to the user through drills.

The program permits interaction by the user, allowing sections to be repeated as needed, or skipping drills when time is a consideration. *SPEED READING . . . The Computer Course* is designed to scroll reading selections at user-specified rates, automatically computing reading rates and comprehension scores. The software automatically records the learner's last rates, speeding future selections slightly to push the user to faster rates.
*(List Price: $125)*
**Requires:** 96K RAM, two disk drives, PC-DOS.
*The Bureau of Business Practice*
*24 Rope Ferry Rd.*
*Waterford, CT 06386*
*(203) 442-4365*

CIRCLE 754 ON READER SERVICE CARD

## SeeCaps

A background program that monitors the CapsLock and the NumLock toggle keys, and displays their status on the screen. This program offers a solution for users for whom the absence of status indicators on the keyboard

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| File Manager Plus | $89.00 |
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| pfs: report | $79.00 |
| pfs: graph | $89.00 |
| Condor 20-III | $389.00 |
| Fox & Geller OZZ | $289.00 |
| Fox & Geller Grafox | $199.00 |
| IUS EasyFiler | $229.00 |
| InfoStar | $299.00 |
| DataStar | $179.00 |
| Personal Data Base | $99.00 |
| InfoScope | $149.00 |
| PerfectFiler | $239.00 |
| Ashton-Tate dBASE II | $389.00 |

## word processing

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|---|---|
| IMSI 4 point Graphics | $139.00 |
| IMSI Visybase | $189.00 |
| Volkswriter | $115.00 |
| Volkwriter (Advanced) | $209.00 |
| SuperWriter | $155.00 |
| Super Spell Guard | $129.00 |
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| Perfect Speller | $119.00 |
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| BenchMark Word Processing | $249.00 |
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| Memo Plan | $129.00 |
| Multi-Mate | $319.00 |
| pfs: write | $89.00 |
| Word Plus PC/The Boss (speller) | $349.00 |
| WordStar | $299.00 |
| MailMerge | $159.00 |
| WordStar/MailMerge | $349.00 |
| WordStar ProPack | $379.00 |
| SpellStar | $159.00 |
| IUS EasyWriter II (Spell/Write/Mail) | $249.00 |
| IUS EasyWriter | $119.00 |

## spreadsheets financial/graphs

| | |
|---|---|
| SuperCalc I | $119.00 |
| SuperCalc II | $159.00 |
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| Lotus 1-2-3 | $319.00 |
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| Cdex Training...each | $49.00 |
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| Peachpack (GL/AP/AR) | $219.00 |
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| Facemaker | $29.00 |
| Hey Diddle Diddle | $24.00 |
| Rhymes & Riddles | $24.00 |
| Snooper Troops 1 | $32.00 |
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### infocom

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|---|---|
| Witness | $32.95 |
| Enchanter | $32.95 |
| Planetfall | $32.95 |
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| Zork 1 | $29.00 |
| Zork 2 | $29.00 |
| Zork 3 | $29.00 |
| Infidel | $32.95 |

### visicorp

| | |
|---|---|
| VisiCalc 4 | $159.00 |
| VisiWord/Spell | $249.00 |
| Visitrend/Plot | $199.00 |
| VisiFile | $199.00 |
| VisiSchedule | $199.00 |
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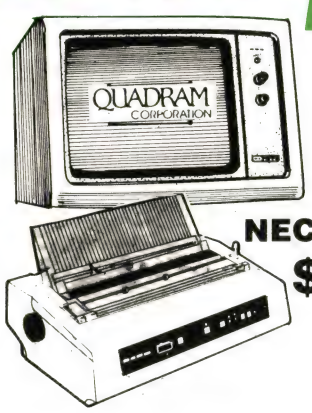
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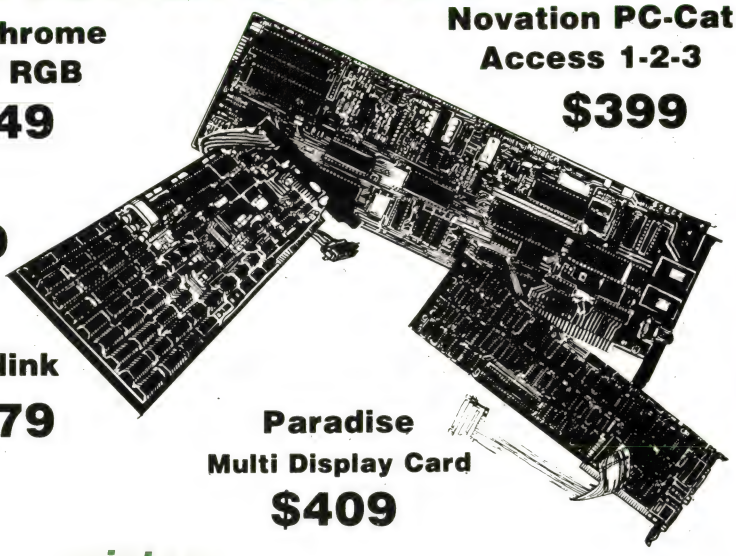
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## modems & communication

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| Hayes 300 | $209.00 |
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| Hayes 1200B | $449.00 |
| Hayes Smart Com II | $75.00 |
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| Novation J-Cat | $119.00 |
| Novation 103 | $189.00 |
| Novation 103/212 | $439.00 |
| Anchor Mark VI | $169.00 |
| Crosstalk XVI | $105.00 |
| Remote | $99.00 |
| Transporter | $199.00 |

## disk drives

| | |
|---|---|
| Tandon 5¼" 320K TM 10-2 | $229.00 |
| Amdisk I | $219.00 |

## percom hard drives

| | |
|---|---|
| 5 Meg w/Controller | $1049.00 |
| 10 Meg w/Controller | $1349.00 |
| 15 Meg w/Controller | $1599.00 |
| 20 Meg w/Controller | $1899.00 |

## diskettes

### maxell

| | |
|---|---|
| MD-1 SS/SD | $29.00 |
| MD-2 DS/DD | $39.00 |

### verbatim

| | |
|---|---|
| SS/DD | $26.00 |
| DS/DD | $36.00 |

### elephant

| | |
|---|---|
| SS/SD | $18.99 |
| SS/DD | $24.99 |
| DS/DD | $29.00 |

## printers

| | |
|---|---|
| NEC 2050 | $999.00 |
| NEC 3550 | $1719.00 |
| NEC 8023AN | $379.00 |
| NEC 8025 | $669.00 |
| NEC 7730 | $1949.00 |
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| Epson (RX80,FX80,FX100 & MX100) | CALL |
| Gemini 10X | $299.00 |
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| Koala Pad w/Micro Painter | $95.00 |

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| 64K, C, S, P | $279.00 |
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| I/O Plus II: | |
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| C, S, P , GP | $169.00 |
| 3870 Emulator | $669.00 |

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### quadram

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CIRCLE 183 ON READER SERVICE CARD

may present a problem.

The program is compatible with the BASIC Interpreter, BASIC Compiler, Macro Assembler, the Cobol Compiler, and with *WordStar*. The program's install function chooses the toggle display location on the screen, and if any conflict with particular software arises, reassigns the location. Once executed, the program becomes resident and will function until the system is reset.
*(List Price: $15)*
**Requires:** 64K RAM, one disk drive, PC-DOS.
*RAMSYS Microsystems*
*225 W. Broadway, #500*
*Glendale, CA 91204*
*(213) 507-8076*

CIRCLE 725 ON READER SERVICE CARD

## Practical Accountant

A menu-driven accounting program designed for small businesses. The program handles receipts, deposits, credit card transactions, accounts payable, accounts receivable, and simple payroll. A running balance column constantly displays current cash, accounts payable, accounts receivable, a projected balance, and a reconciled balance. In addition, the program prints checks with vouchers and gives detailed cash flow reports that can be viewed on screen, printed, or used as text files with other programs.




***StoreMinder Software Series, Xtrasoft***

A chart of accounts can be defined with 50 income/expense categories and 400 subcategories. Tax classifications can also be defined for tax purposes. Features like a single-entry format menu, on-screen printing, and the use of the function keys to enter commands are designed to make the program easy to use.
*(List Price: $149.95)*
**Requires:** 128K RAM (PC-DOS 1.1); 192K RAM (PC-DOS 2.0); one disk drive.
*Softlink Corp.*
*3255-2 Scott Blvd.*
*Santa Clara, CA 95051*
*(408) 988-8011*

CIRCLE 721 ON READER SERVICE CARD

## StoreMinder Software Series

Three programs for retail businesses. The individual programs, which can run individually or as an integrated system, are: *SalesMinder*, a point-of-sale program; *StockMinder*, inventory management software; and *MailMinder*, a mailing list/customer profile program.

Features of the *StoreMinder Series* include bar code reader input capability; preset multiple price levels; custom price-label printing; the ability to handle fractional quantities of items; assignment of unique commission rates for each item; and user-selectable multiple terminal operation. The software can also provide the retailer with a profitability index (Gross Margin times Return on Investment).
*(List Price:* Unavailable at press time)
**Requires:** 192K RAM, one disk drive, hard disk, PC-DOS 2.0, parallel port, optional serial port.
*XtraSoft*
*553 Weddell Dr.*
*Sunnyvale, CA 94089*
*(408) 747-1400*

CIRCLE 759 ON READER SERVICE CARD

## InteSoft

An integrated software series consisting of five programs: *InteBase, InteVate, InteCalc, IntePlan,* and *IntePERT*. *InteBase* is a database management system

NEW!

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The first programming language that talks like you do!

```
 LIST
10  REM #---ACRECO10---
20  REM #---CUSTOMER NAME AND ADDRESS LOAD PROGRAM---
60  DIM B$(15)/DIM C$(20)/DIM D$(20)/A6$(1,8)="ZZ"
70  J=0/OPEN #0, "CUSTMST,2"
80  GOSUB 400
90  J=G
100 GOSUB 400
110 N=0
120 !"LAST CUST # ENTERED WAS ",F," ", A$," ",B$
130 !
140!"TO END PROGRAM ENTER 9999 AT CUST #"
150 J=J$1
160 !"ENTER FOLLOWING:"
170 GOSUB 520
180 INPUT "CUT # ",F
190 IF F=9999 THEN 490
200 IF F =N THEN 220
210 N=F/GOTO 240
220 !"SEQUENCE ERROR-RETYPE"
230 GOTO 160
240 INPUT "1ST NAME ", A$(1,8)
250 IF A$=A6$ THEN 380
260 INPUT "LST NAME ", B$(1,15)
270 IF B$(1,2)=A6$(1,2) THEN 380
280 INPUT "ADRS LIN1 ",C$(1,20)
290 IF C$(1,2)=A6$(1,2) THEN 380
300 INPUT "ADRS LIN2 ",D$(1,20)
310 IF D$(1,2)*A6$(1,2) THEN 380
320 INPUT "TEL # ",E$(1,8)
330 IF E$(1,2)=A6$(1,2) THEN 380
340 INPUT "MO PMT AMT ",G
350 IF G=999 THEN 380
360 GOSUB 420
370 GOTO 150
380 N=N-1
390 GOTO 170
400 READ #0%96#J,A,F,A$,B$,C$,E$,G
410 RETURN
420 WRITE #0%96#J,A,F,A$,B$,C$,D$,E$,G
430 K=0/G=J
440 WRITE #0%96#J,A,F,A$,B$,C$,D$,E$,G NOENDMARK
450 RETURN
460 J=0
470 GOSUB 420
480 GOTO 140
490 REM #---CLOSE ROUTINE---
500 CLOSE #0
510 END                                          '/REM 20 BLANKS
520 C$(1,20)="                    "
530 D$=C$/A$=C$/B$=C$/E$=C$
540 RETURN
```

Basic

```
ACCOUNTS RECEIVABLE is a file.
    1 Uses      CUSTOMER NUMBER
    2 and       CUSTOMER NAME
    3 and       ADDRESS
    4 and       CITY STATE ZIP
    5 and       TELEPHONE NUMBER
    6 and       MONTHLY PAYMENT AMOUNT


ADD TO CUSTOMER FILE is a verb.
    1   Does    MESSAGE     "What is the customer number?"
    2   and     INPUT       CUSTOMER NUMBER
    3   and     MESSAGE     "What is the customer's name?"
    4   and     INPUT       CUSTOMER NAME
    5   and     MESSAGE     "What is the street address?"
    6   and     INPUT       ADDRESS
    7   and     MESSAGE     "What is the City State and Zip Code?"
    8   and     INPUT       CITY STATE ZIP
    9   and     MESSAGE     "What is the customer's phone number?"
    10  and     INPUT       TELEPHONE NUMBER
    11  and     MESSAGE     "What will the customer pay monthly?"
    12  and     INPUT       MONTHLY PAYMENT AMOUNT
    13  and     SAVE by CUSTOMER NUMBER in file ACCOUNTS RECEIVABLE
    14  and     REPEAT
```

plain english®

```
IDENTIFICATION DIVISION.
PROGRAM-ID.
  TEST.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER      RMC.
OBJECT-COMPUTER      RMC.
INPUT-OUTPUT SECTION.
FILE-CONTROL.
  SELECT AR-MASTER ASSIGN TO RANDOM "/u/files/armast"
    ; ORGANIZATION IS INDEXED
    ; ACCESS MODE IS DYNAMIC
    ; RECORD KEY IS CUSTOMER-NUMBER.
DATA DIVISION.
FILE SECTION.
FD  AR-MASTER LABEL RECORDS ARE STANDARD.
01  AR-REC.
    05 CUSTOMER-NUMBER                    PIC X(4) .
    05 CUSTOMER-NAME                      PIC X(20).
    05 CUSTOMER-ADDRESS                   PIC X(40).
    05 CUSTOMER-CITY-STATE-ZIP            PIC X(40).
    05 CUSTOMER-PHONE                     PIC X(10).
    05 CUSTOMER-PAYMENT-AMOUNT            PIC 9(5) .
WORKING-STORAGE SECTION.
PROCEDURE DIVISION.
RESIDENT SECTION 1.
STAR-UP.
  OPEN OUTPUT AR-MASTER.
LOOP.
  DISPLAY "ENTER CUSTOMER NUMBER OR . TO EXIT
  ACCEPT CUSTOMER-NUMBER PROMPT .
  IF CUSTOMER-NUMBER = "." GO TO END-OF-JOB.
  DISPLAY "ENTER CUSTOMER NAME
  ACCEPT CUSTOMER-NAME PROMPT
  DISPLAY "ENTER CUSTOMER ADDRESS
  ACCEPT CUSTOMER-ADDRESS PROMPT.
  DISPLAY "ENTER CUSTOMER CITY,STATE,ZIP
  ACCEPT CUSTOMER-CITY-STATE-ZIP PROMPT.
  DISPLAY "ENTER TELEPHONE NUMBER
  ACCEPT CUSTOMER-PHONE  PROMPT
  DISPLAY "ENTER CUSTOMER PAYMENT AMOUNT
  ACCEPT CUSTOMER-PAYMENT-AMOUNT  PROMPT.
  WRITE AR-REC INVALID KEY GO TO BAD-ADD.
  DISPLAY "CUSTOMER RECORD SAVED".
  GO TO LOOP.
BAD-ADD.
  DISPLAY "INVALID CUSTOMER".
  GO TO LOOP.
END-OF-JOB.
  CLOSE AR-MASTER.
  STOP RUN.
```

Cobol

Compare Plain English to any other language, as shown in the charts above. Eliminate the complexities and rigid structures of the **old** traditional languages.

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Plain English is perfect for the first time programmer and meets the requirements of experienced ''coders''. An easy to understand TUTORIAL and helpful REFERENCE MANUAL (written in plain english by the way) will allow **anyone** to learn Plain English in as little as four hours.

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CIRCLE 371 ON READER SERVICE CARD

with multiple window capabilities. In concert with *InteVate*, an applications generating component, the system allows the user to create automated procedures in such areas as bookkeeping, payroll, project planning, inventory control, and sales analysis.

The *InteCalc* financial spreadsheet component of the series can access any information entered via any other component in the series. The spreadsheet also has split-screen and multiple-screen display capabilities.

The *IntePlan* component provides the series with executive time management facilities. It organizes schedules and calendars, displays agendas, and maintains up to nine separate accounts for totalling income received, amounts paid, hours worked for a particular client, and so on.

Finally, the *IntePERT* critical path method component, when used in conjunction with the other components, can project consequences of resource and schedule changes and chart which tasks require which resources, how many resources are needed, and for what periods of time, in calculating and/or analyzing a project.
*(List Price: $149-$495, depending upon program; three-program set $495)*
**Requires:** 128K RAM, two disk drives, PC-DOS.
*Schuchardt Software Systems, Inc.*
*515 Northgate Dr.*
*San Rafael, CA 94903*
*(800) 421-1144*
*(800) 421-1145 in Calif.*
*(415) 492-9330*

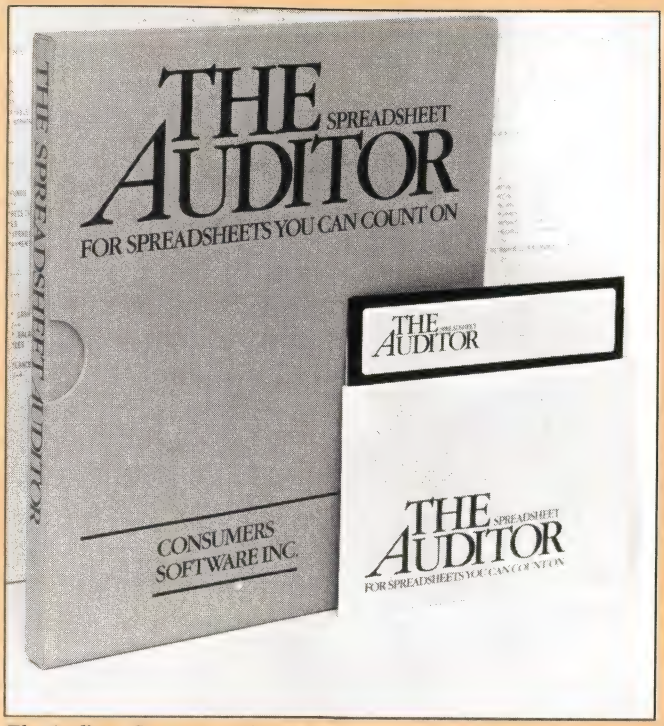
CIRCLE 720 ON READER SERVICE CARD

## SIGSTAT

A statistical analysis package, based upon the *BMD* statistical package. *SIGSTAT* provides a range of statistical procedures for data presentation and analysis. The software incorporates 32 separate programs, including univariate and multivariate analysis of variance and covariance (including repeated measures); general linear models; regression (multiple, stepwise, best subset, ridge, polynomial, periodic and harmonic, nonlinear least squares); factor analysis (three rotations, capable of producing factor scores); canonical correlations (produces canonical variables); discriminant analysis (multi-group, stepwise); life table and survival rate; time series (autocovariance and power spectral analysis); and probit, cross-tabulations, chi square, log linear, residuals, histograms, scatter plots, and data transformations.

*SIGSTAT* can handle up to 80 variables on 32,767 cases, including pairwise and listwise deletion options for missing variables. Also available is support for the 8087 math coprocessor.
*(List Price: $325)*
**Requires:** 128K RAM, one disk drive, PC-DOS.
*Significant Statistics*
*3336 N. Canyon Rd.*
*Provo, UT 84604*
*(801) 377-4860*

CIRCLE 723 ON READER SERVICE CARD




***The Auditor*, Consumer Software Inc.**

## The Auditor

A spreadsheet enhancement program, permitting the user to display and analyze the formulas used within a spreadsheet. Formulas are displayed in an easy-to-read grid; long formulas can be wrapped to the next line for reading. Each page is numbered and is displayed with column labels and row numbers for easy reference.

*The Auditor* is compatible with *VisiCalc*, Lotus' *1-2-3*, and *SuperCalc*. *1-2-3* users also get a complete listing of all named and other special ranges contained in their worksheets along with the standard formula display.
*(List Price: $99)*
**Requires:** 128K RAM, two disk drives, PC-DOS, spreadsheet software.
*Consumers Software Inc.*
*314 E. Holly St., #106C*
*Bellingham, WA 98225*
*(800) 645-5501*
*(604) 688-4548*

CIRCLE 755 ON READER SERVICE CARD

## STAR FLEET I

The first program in a game software series designed around a starship fleet concept. The player becomes an officer of STAR FLEET, commanding one of 35 galactic heavy cruisers. The cruiser, with a crew of 500, patrols a sector of space encompassing 13 star systems. Game missions include rescuing other ships and star bases from attack by enemy craft, capturing and towing enemy vessels, laying mine fields, searching for saboteurs, and repairing damaged ship's systems while maintaining crew morale and espirit de corps. The game makes use of color screens, animated battle sequences, music, and strategy planning. All commands are made with function keys.

*(List Price: $49.95)*

**Requires:** 96K RAM, one disk drive, PC-DOS 1.1, monochrome or color/graphics adapter, BASICA.

*Cygnus*
*P.O. Box 57825*
*Webster, TX 77598*
*(713) 486-4163*

CIRCLE 762 ON READER SERVICE CARD

## EasyE-COM

An electronic mail program used to transmit letters via the U.S. Postal Service's E-COM system. After the user has prepared a letter with any word processing program, the disk files containing the letters and addresses are processed by *EasyE-COM* and a submittal file is generated containing all required E-COM control blocks, formatted addresses, and text blocks. This file is then transmitted to the Postal Service using an included asynchronous communications program and the user's modem.

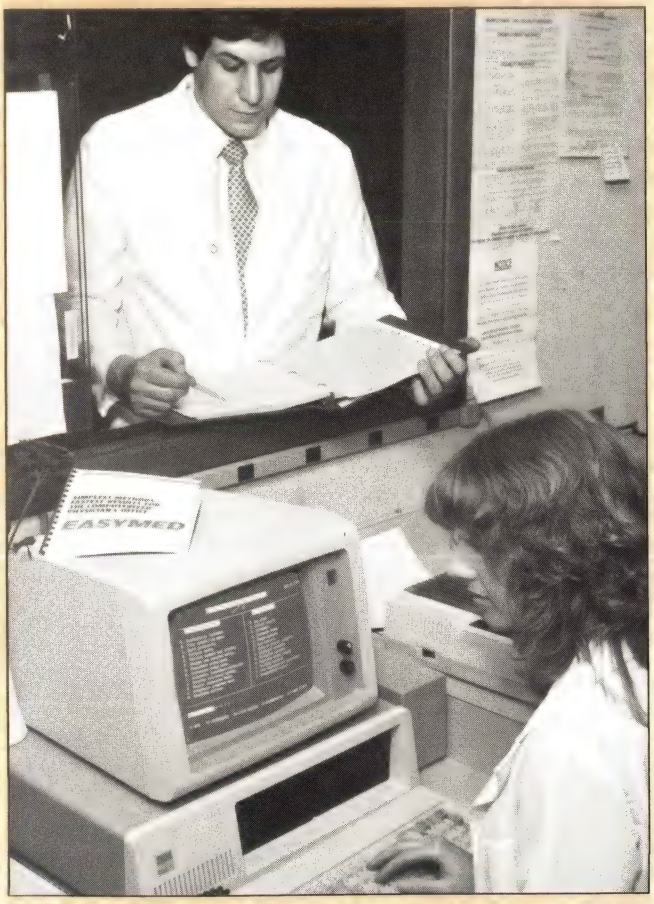
*EasyE-COM* also includes an integrated accounting feature, making it possible for the service-bureau user to accurately track the costs attributable to clients for which the E-COM letters are prepared.

*(List Price: $450; demo disk $35)*

**Requires:** 64K RAM, one disk drive, PC-DOS, serial port, Hayes Smartmodem or equivalent.

*Easy Soft, Inc.*
*601 W. Fifth St., #650*
*Los Angeles, CA 90017*
*(213) 838-2367*

CIRCLE 714 ON READER SERVICE CARD




***EASYMED**, Medical Computer Consultants*

## EASYMED

A medical office management program capable of maintaining records for up to 32,000 patients. Features include a time scheduling capability, which can produce schedules for doctors and/or examining/operating rooms; automatic generation of patient recall notices; word processing facilities; and automatic patient statement or insurance form generation.

For following up on delinquent accounts, *EASYMED* prints all past due balances with the guarantor's telephone number, charges, and insurance details. Collection reports list charges, payments made, and insurance information for accounts sent to collection. An Accounts Recap report monitors the collection agency's progress. Charge and cash analyses list all transactions posted between specified dates, permitting the doctor or accountant to analyze the practice at any time.

*(List Price: $2,495)*

**Requires:** 128K RAM, one disk drive, 10MB hard disk, PC-DOS.

*Medical Computer Consultants*
*95 Madison Ave.*
*Morristown, NJ 07960*
*(201) 539-3833*

CIRCLE 763 ON READER SERVICE CARD

## Math Maze

A math game for children, where the player must maneuver a fly (the cursor) through intricate passages to escape a spider. The fly is safe as long as the child correctly answers problems in addition, subtraction, multiplication, and division.

To begin the game, the player chooses from 40 different mazes, or creates a new labyrinth. Scattered throughout the maze are the digits zero through nine. The player then selects a type of math operation and its difficulty level. A problem appears and the player guides the fly through the maze to gather the digits of the correct answer.

*(List Price: $39.95)*

**Requires:** 64K RAM, one disk drive, PC-DOS.

*DesignWare, Inc.*
*185 Berry St., #158*
*San Francisco, CA 94107*
*(415) 546-1866*

CIRCLE 757 ON READER SERVICE CARD

## RXWriter

A set of programs for writing prescriptions. *RXWriter* is designed to be used by physicians in an office practice and can speed up prescription writing while creating a computer file of prescriptions which can later be searched. Prescriptions are written in duplicate, one to be signed and given to the patient, the second for the patient's clinical record. Advantages of the program include the ability to produce compound prescriptions easily; prescriptions are legible, drug names cannot be misspelled; Latin abbreviations are expanded and printed in English; and strings of text can be inserted anywhere within a prescription.

The program permits as many as six prescriptions to be produced on a single form. If more than one physician uses the system, a physician's name and signature line can be placed at the bottom of prescription forms. The selected name is printed below the signature line.

A help routine is included in *RXWriter* which provides a rapid look at the information on drugs in the physician's drug file. The help function can be accessed while within the prescription-writing function.

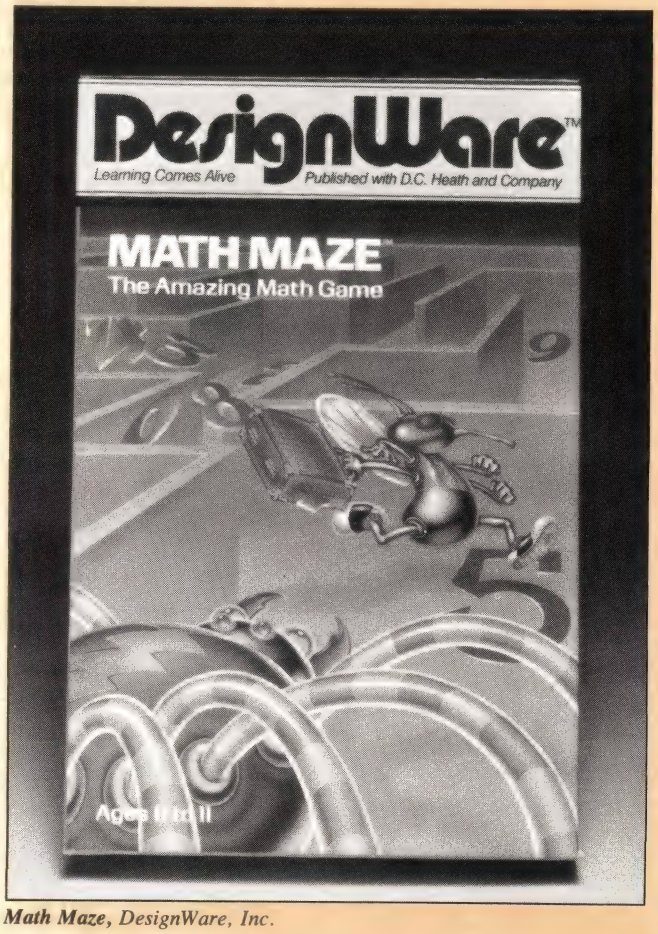
*RXWriter* also automatically creates a disk file containing the patient's name, the date, the diagnosis (if one was entered), and the prescription abbreviations. This file can later be searched by a utility program included with the software, which permits data retrieval by patient's name, by date, by diagnosis, or by drugs prescribed.

*(List Price: $100; manual alone $8)*

**Requires:** 128K RAM, one disk drive, PC-DOS.

*Hall Design*
*250 Maple Ave.*
*Wilmette, IL 60091*

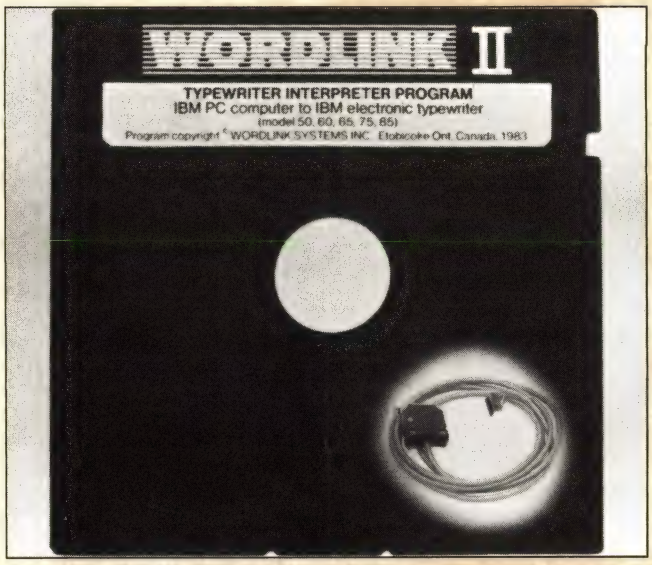
CIRCLE 722 ON READER SERVICE CARD




***Math Maze**, DesignWare, Inc.*

## Tax Relief I & II

Two tax packages, one each for personal and professional use. The professional tax package, *Tax Relief II*, supports 25 schedules and forms, including Form 1040 and all lettered schedules. Income averaging, minimum tax, and alternate minimum tax are calculated automatically. Calculations are carried over to all relevant places as needed, eliminating duplication of data entry. Summaries of client tax returns are provided for quick reference, and a directory is maintained containing a complete record of all prepared returns. An on-line HELP facility is provided for data entry, and input forms that correspond exactly to screen format are provided with the package. Several options for printing are offered, including printing on IRS forms and print-




***Wordlink II**, Wordlink Systems Inc.*

ing on blank paper in order to make use of overlays and batch printing.

*Tax Relief I* supports 15 of the most commonly used schedules and forms. All features of *Tax Relief II* that are relevant for individuals are included.
*(List Price: Tax Relief I, $149; Tax Relief II, $299)*
**Requires:** 128K RAM, two disk drives, PC-DOS 2.0.
*Micro Vision*
*145 Wicks Rd.*
*Commack, NY 11725*
*(516) 499-4010*

CIRCLE 724 ON READER SERVICE CARD

## Wordlink II

A software-based interface for users with IBM electronic typewriters, permitting the typewriter to be used as a letter-quality printer. Designed to eliminate most of the hardware associated with typewriter interfaces, a *Wordlink II*-equipped typewriter can be used as a primary or backup printer. The software can produce hardcopy at up to 200 words per minute.

*Wordlink II* is currently available for the IBM electronic typewriters models 50, 60, 65, 75, 85, and 95.
*(List Price: 5-foot cable $99; 10-foot cable $119)*
**Requires:** 64K, one disk drive, PC-DOS, parallel port.
*Wordlink Systems Inc.*
*1 Eva Rd., #211*
*Toronto, Ontario M9C 4Z5*
*Canada*

CIRCLE 753 ON READER SERVICE CARD

## The Manager Program Collection

A collection of three integrated programs combining time, project, and "card file" records management capabilities. The three programs, *Task Manager, Records Manager,* and *Project Manager*, share data and a tutorial called *Dimension Aid*, included with the package.

*Task Manager* is a calendar and journal system that can help manage appointments, identify significant dates, categorize activities, and organize the track expenses. Tasks, schedules, and appointments are organized into 26 user-definable categories; five priority levels help rank each activity. Keywords, categories, or priority levels can be specified to speed searches for specific historical or future events. Incomplete activities from past days can be automatically posted on the current day. *Task Manager* also offers a job expense journal with nine definable accounts to track expenses, client billing, hours worked, and income received.

*Project Manager* aids project planning by organizing projects and available resources. The program can calculate critical paths; prepare PERT, GANTT, schedule, task, or time charts; analyze resource allocations; determine slack time, and use alternative model approaches toward completion of a project. Extended detail on each project is also available, with as many as 62 subdivisions.

*Records Manager* is a "card file" type database management system that can be used to maintain client, associate, or personnel records. It can be user-adapted to meet other data keeping needs. Information is organized in four levels (called general, detailed, project, and resume) against 26 categories, each with sorting and selection criteria defined. The project level can track planned and actual start/end dates, status, and outcomes. The resume level can be used to store related information.
*(List Price: All three programs: $499)*
**Requires:** 192K RAM, two disk drives, PC-DOS.
*Datamension Corp.*
*615 Academy Dr.*
*Northbrook, IL 60062*
*(312) 564-5060*

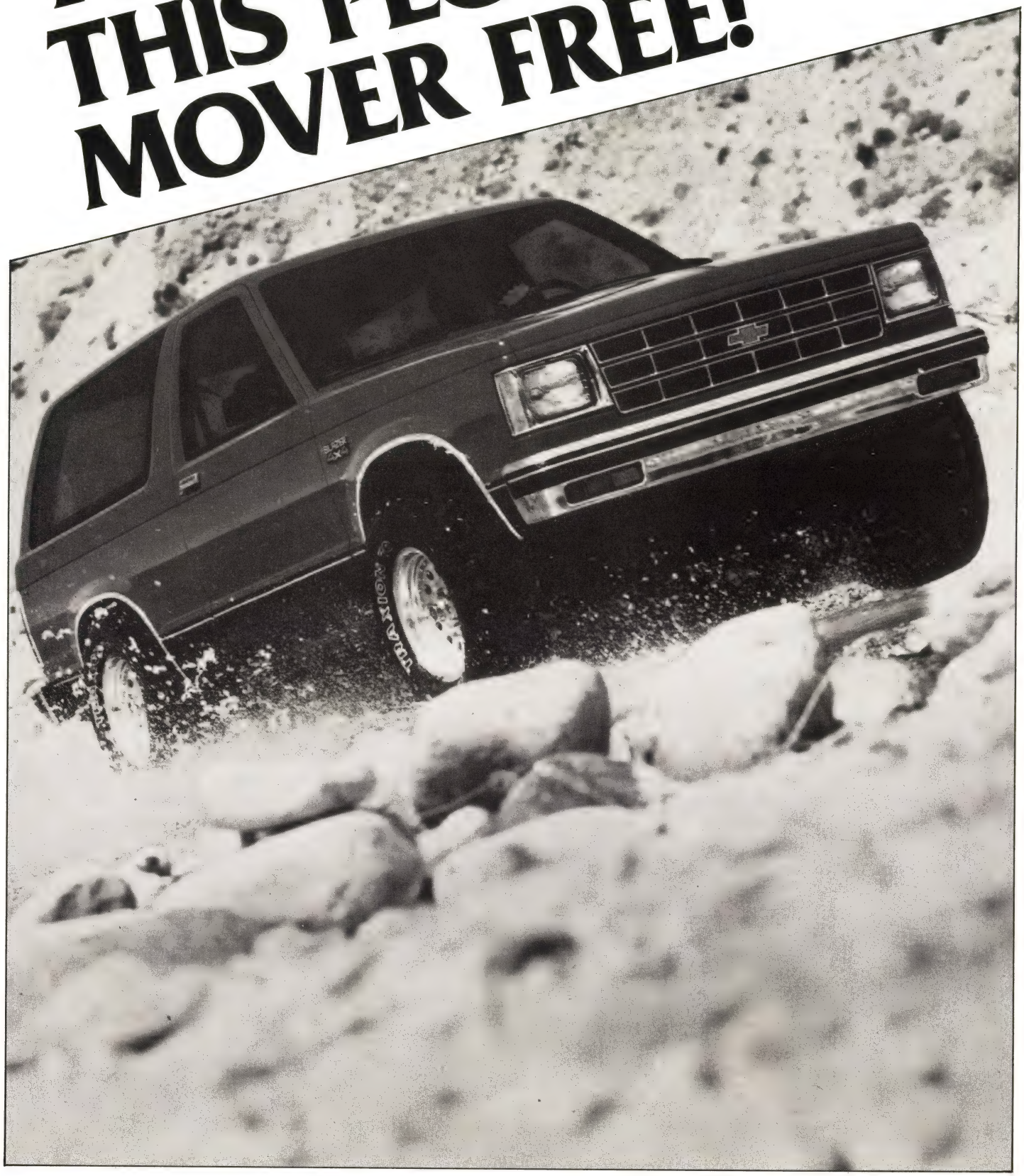
CIRCLE 716 ON READER SERVICE CARD

## Spellakazam

A game to teach children spelling skills, as well as improve the learner's hand-eye coordination. Sentences appear with a missing word. The player must correctly guess and spell the word before racing an on-screen magician to a magic hat. To enter the chosen word, the player must move quickly over rows and columns of letters arranged alphabetically.

The player wins points for correctly spelling the

# YOU CAN WIN THIS PEOPLE MOVER FREE!



# JUST GIVE US A GREAT NAME FOR THIS DATA MOVER.

## FIRST EVER "ELECTRONIC" DISK FOR THE IBM PC.



That's right. You can win a brand new Chevy S-10 Blazer. FREE. All you have to do is submit the best name for our exciting new "ELECTRONIC" DISK. A name that reflects its function and performance as a floppy disk replacement.

### WHAT IS AN "ELECTRONIC" DISK

"ELECTRONIC" DISK is the functional name we've given to this first-of-a-kind product for the IBM PC & XT. It's an operation-ready module offering to 368 KB for new or existing PCs. There's no software or sub-routines required. Just plug one in and you get instant data access ...up to 50x faster than a conventional floppy disk. And without inherent head and disk wear. Or electro-mechanical failures and data loss. The module also offers a U.P.S. (uninterruptible power supply) to make sure you won't lose data from power "glitches" or when power is temporarily removed.

### WHY YOU'LL WANT ONE

The "ELECTRONIC" DISK gives your computer greater power for personal, multi-tasking or multi-user applications. You'll be able to continuously scroll documents, instantaneously look-up records, sort data and other disk bound processes at high speed. All without the start-stop aspect of typical operations regardless of operating system used.

### SUBMIT YOUR WINNING ENTRY TO THE "NAME OUR PRODUCT" CONTEST

There is no obligation when you enter the "Name our Product" contest. Simply pick up an official entry blank from any participating IBM PC dealer. While you're there, your dealer can give you complete details on the "ELECTRONIC" DISK. Or, you can request an entry form and details directly from the factory by writing to the address below. Please include a stamped, self-addressed business size envelope.

### I WANT TO ENTER YOUR "NAME OUR PRODUCT" CONTEST

___ Please send me an official entry blank
___ Please tell me the name of the nearest participating IBM PC dealer

Name_____ Title (if appropriate)_____

Company(if appropriate)_____

Address_____

City_____ State_____ Zip_____

DILOG PC PRODUCTS

DILOG PC PRODUCTS
Distributed Logic Corporation
12800 Garden Grove Blvd.
Garden Grove, CA 92643
Phone: (714) 534-8950

CIRCLE 142 ON READER SERVICE CARD

missing word. Extra points are scored if the player can also manage to beat the magician to the top hat. Each time a player spells a word properly, an animal pops out of the hat and inserts the word in the blank portion of the sentence.

The game incorporates a 400-word dictionary, to which players can add additional words.
*(List Price: $39.95)*
**Requires:** 64K RAM, one disk drive, PC-DOS.
*DesignWare, Inc.*
*185 Berry St., #58*
*San Francisco, CA 94107*
*(415) 546-1866*

CIRCLE 756 ON READER SERVICE CARD

## Air Trax

A real-time simulation game in which the player assumes the combined responsibilities of an air traffic controller and a Federal Aviation Administration inter-airport airflight coordinator. The assigned airspace is a 20 × 20 mile area that includes one or more airports and runways, depending on the level of difficulty achieved.

The player begins in an entry-level air traffic controller position at a low traffic-density location with well-defined flight schedules. Successful performance is rewarded with salary increases, bonuses, and advancement to more demanding locations, featuring high-density traffic and variable flight schedules. The ultimate objective is to master the world's busiest airport, Chicago's O'Hare.

Features of the game include six game speeds, game hold/help, aircraft of differing sizes and characteristics, and 26 airport/traffic patterns (both fixed and random), including one the player can custom-design.

*Air Trax* does not require a color/graphics adapter board to run on the user's system.
*(List Price: $44.95)*
**Requires:** 48K RAM, one disk drive, PC-DOS.
*Control Concepts, Inc.*
*P.O. Box 2367*
*Manassas, VA 22110*
*(800) 368-3078*
*(703) 631-0435*

CIRCLE 717 ON READER SERVICE CARD




***Spellakazam**, DesignWare, Inc.*

## Compu-Chef Culinary Guide

A computerized recipe file, containing a selection of approximately 90 recipes. Each recipe can be automatically adjusted for the number of servings required.

In addition to the programmed recipes, the *Compu-Chef Culinary Guide* includes a set of appendix files. The appendices cover culinary terminology, caloric values of foods, a guide for herbs and spices, and other categories.
*(List Price: $24.95)*
**Requires:** 128K RAM, one 320K disk drive, PC-DOS.
*DeAmicis Software Development*
*4193 Galbar St.*
*Oceanside, CA 92056*
*(619) 758-4766*

CIRCLE 718 ON READER SERVICE CARD

# ACCESSORIES

## The Silencer

A plug-in board that eliminates the audible speaker noise generated by some 256K RAM expansion boards. The board installs easily in one slot within the user's system, and does not affect the normal operation of the system's speaker.
*(List Price: $29)*
*Wilton Digital, Inc.*
*P.O. Box 1845*
*Melbourne, FL 32902*
*(305) 727-7379*

CIRCLE 784 ON READER SERVICE CARD

## The Micro Saver

A multiple-outlet strip incorporating surge protection and line noise filtering circuitry. The unit comes with an easily installed mounting bracket which allows it to



***Mini-Printer Stand,*** *Bretford Manufacturing Inc.*

be attached to a desk table.

One of the strip's four outlets has been set apart from the others, permitting the user to plug in a step-down transformer without hampering access to the other outlets. Other features of the Micro Saver strip include a nine-foot power cord and a lighted, recessed power switch. The outlet strip is UL listed and its circuitry conforms to standards established by the Institute of Electrical and Electronic Engineers.

*(List Price: $69.95)*
*Kensington Microware*
*251 Park Ave. So.*
*New York, NY 10010*
*(212) 475-5200*

CIRCLE 785 ON READER SERVICE CARD

## Parallel Printer Switch

A battery-operated printer switch allowing two printers to be connected to a single parallel port in the user's system. The switch, Model 8310, permits the user to select the desired printer with a toggle switch. It can operate for up to one year with a single general purpose 9-volt battery.

*(List Price: $75)*
*Felloe Corp.*
*P.O. Box 604*
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*(201) 754-5393*

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## MICROREF Guides

A series of three printed reference guides designed to help microcomputer users learn *SuperCalc* (including *SuperCalc II*), *Multiplan*, and *VisiCalc*. The thumb-indexed guides present the most often used software procedures step by step, and provide illustrations, a glossary of terms, an index, and a built-in support easel.

The MICROREF guides are designed for both new and experienced users, with an emphasis on speedy, time-saving instruction methods.

*(List Price: $14.95)*
*Educational Systems, Inc.*
*1000 Skokie Blvd.*
*Wilmette, IL 60091*
*(312) 256-4750*

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## Computer-Plus Care Kit

A computer cleaning kit consisting of an anti-static treatment, an anti-static cleaner, and reusable cleaning swabs. CLEAR 1, an antistatic treatment, and CLEAR 2, a cleaning solution, each come in 8 ounce spray bottles. Both can be used directly on work surfaces, display screens, and peripherals, as well as on work surfaces and the rest of the data processing area. They are nonflammable, nontoxic, and safe for use on any material that will not water-spot.

*(List Price: $29.95)*
*White's Computer Supplies*
*3348 Niles Rd.*
*St. Joseph, MI 49085*
*(616) 429-2545*

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## PIXTIK

A real-time clock which is fitted to the PC externally, eliminating the need for an add-on board. The clock is plugged into the parallel printer port, and the user's printer is plugged into the clock module. The PIXTIK clock does not affect operations of the printer.

The unit has an integral Ni-Cad rechargeable cell which provides date and time retention while the computer is not powered up, for up to 2 years.

Software is provided for automatic updating of the internal PC-DOS clock at system start-up time, to ensure that the date and time are always correct. The clock uses a 24-hour time format, has full date facilities including leap year correction, and also provides automatic summer time-adjustment corrections.

*(List Price: $49.99)*
*PIXEL-PLUS Ltd.*
*31 Barton Lane*
*Nailstone, N. Nuneaton,*
*Warks, GB CV13 OPY*
*0530-62565*

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## Mini-Printer Stand

A stand for elevating an 80-column printer, available in two models. The WSPS-1 model will elevate a printer with a 9½-inch paper feed and can accommodate a continuous flow of paper. The WSPS-2 stand elevates a larger printer with a 15-inch paper capability. Each unit has a slot accommodating the appropriate bottom

feed printer.

The printer stands are constructed of solid steel and are finished in putty beige enamel.

*(List Price: WSP1 $32; WSP2 $43)*
*Bretford Manufacturing Inc.*
*9715 Soreng Ave.*
*Schiller Pk., IL 60176*
*(312) 678-2545*

CIRCLE 793 ON READER SERVICE CARD

## Executive Computer Desk

A desk designed to house all of a user's PC components. Within the single cabinet, it has sufficient capacity for the systems unit, monitor, keyboard, printer, plotter, modem, expansion chassis, paper, and software documentation. The Executive Computer Desk is available in oak or walnut.

*(List Price: $662 oak, $729 walnut)*
*Packer Woodworking*
*10 Brook Trail Rd.*
*Concord, MA 01742*
*(617) 491-5200*

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## ERGO-TECH

An ergonomic workstation with a full range of adjustments, designed to reduce operator fatigue by reducing eye and back strain and positioning the body in a comfortable posture.

The overall height of the unit is 31 inches. The keyboard surface adjusts from heights of 26 to 28 inches, and the monitor surface adjusts from 30 to 32 inches. Both surfaces tilt and adjust either toward or away from the operator.

*(List Price: $295)*
*James Systems Division*
*2929 N. Oakley Ave.*
*Chicago, IL 60618*
*(312) 472-2611*

CIRCLE 790 ON READER SERVICE CARD

## EC-15 Computer Table

A steel table with an adjustable top shelf and work surface, designed to accommodate a variety of microcomputer systems. The table incorporates a power strip with a single neon-lighted switch, located on the front of the work surface, which can turn the entire system on and off.

The 15-ampere switch and its connectors are housed in a protective channel under the work surface, with a grounded outlet at the rear of the channel. The table has 1-inch square tubular steel legs on 4-inch casters, two with locking brakes. It is finished in putty beige enamel.



***EC-15 Computer Table,** Bretford Manufacturing Inc.*

*(List Price: $280)*
*Bretford Manufacturing Inc.*
*9715 Soreng Ave.*
*Schiller Park, IL 60176*
*(312) 678-2545*

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# PUBLICATIONS

## Software Digest Ratings Newsletter

A newsletter designed to help readers find the best and easiest-to-use applications programs. The programs, divided into categories, are evaluated by 10 individual users whose ratings are averaged.

*(List Price: $90 for six issues)*
*Software Digest, Inc.*
*1 Wynnewood Rd.*
*Wynnewood, PA 19096*
*(215) 649-7000*

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## Kelly-Grimes Buyers Guide

A product directory designed to serve as an initial reference to computer systems, software, peripherals, accessories, and supplies. The guide explains computer features and terminology in a nontechnical manner, providing information both for buying a new system and for expanding existing systems. A glossary, a software index, and product comparison charts are included.

# $$More Computer for Your Calculating Dollar$$

## Try the New

# XPC-XT by XOR

## Introductory Offer

*(Offer expires May 31,1984)*

# $1995.00

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***"Need a 16-bit IBM-PC™ to process your data?"***

The first IBM™ compatible that **IS** compatible! A complete system including the PC-DOS™ operating system from IBM™. Two thinline double-sided 5¼" Disk Drives hold 360K of formatted storage each, the other drive opening is fitted with a close-out plate. Removal of the plate will allow room for a Winchester Hard Disk. The Power Supply is like that of an IBM-PC XT™..Hard Disk ready! How compatible is the **XPC-XT**? It will run 1-2-3™, Flight Simulator™, dBASE II™, WordStar™, SuperCalc™, VisiCalc® and hundreds of others, The system will also support MS-DOS™ 1.1 and 2.1, PC-DOS™ 2.2, CP/M-86™ and Unix Operating Systems. Add-on an additional 192K of RAM for a full 256K of on-board Memory for only **$195.00**. This computer comes standard with 2 Serial and 1 parallel ports (IBM™ COM1 and COM2). No need to purchase Add-On cards.

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This super reliable, four layer design Memory Card can be expanded from 64K to 576K in 64K increments (at **$75.00** ea.). We've tested them all and can recommend this one with confidence. The price below is with 64K and includes Spooler and RAMDISK software.
BOA-8650-00 ..... **$255.00**

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### 300/1200 BAUD MODEM



If this is your first computer, you will soon want it to Communicate. Compuserve and The Source are on your screen minutes after you plug-in this Custom Made Unit. Supplied with cable to plug into any wall outlet. Auto-Dial Software "remembers" phone numbers and log-in sequences to ease operation. Software included for each operating system. BOA-8725-00 ..... **$295.00**

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Now we need a full page to describe this fantastic Card! Since we only have a little room, here are the features: IBM™ compatible Joystick Port (2), Real-Time Chronograph (Battery Back-up), Parallel Port, Serial Port, 64K to 384K of Parity Memory, Print Spooler and RAM-DISK software, and supplied with 0K of Memory.
BOA-8680-00 ..... **$345.00**

XDS MANUFACTURING

## HARD DISK ADD-ON

### *Complete Packages*

Includes BIOS Software, 5¼" Winchester Hard Disk, mounting hardware, Interface P.C.B. for expansion slot, and all the necessary power and data cables (the Power Supply in the **XPC-XT** is Hard Disk ready).

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| **10 Megabyte** | **65 Megabyte** |
| **$995** | **$2495** |
| **20 Megabyte** | **105 Megabyte** |
| **$1295** | **$3295** |
| **40 Megabyte** | **140 Megabyte** |
| **$1795** | **$4195** |

**Archive Tape Back-up** unit shown above is of 20 and 40 megabyte capacity. **Memtek** unit will soon be available at 10 megabyte capacity at approximately **One-Half the cost!**

### MONOCHROME ADAPTOR



If you are impressed with all the rave reviews that the Hercules Graphics Card gets, you will love ours! Made expressly for the **XPC-XT** by Hercules themselves, it runs everything the Hercules Card does (1-2-3™, dBase II, etc.). BOA-8500-00 .... **$395.00**

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Color and monochrome combinations, can be run *simultaneously*. Flight Simulator™, 1-2-3™ all perform without modifications. *NO FLICKER!* Besides performing perfectly, included are: Light Pen Interface, Print Spooler, and RAM Disk options! BOA-8400-00 ..... **$495.00**

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### MONOCHROME

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This package consists of a combination Interface Adaptor having SCSI H.D./TAPE Connector as well as the Floppy Controller. Two additional 5" form factor Boards are included and mount over the Tape Drive and Hard Disk. 10, 20, & 40 megabytes of Back-up is added to your Hard Disk. BOA-8675-00 ..... **$750.00**

**XDS Manufacturing ■ 5791 Machine Drive ■ Huntington Beach, CA 92649 ■ 714/898-0336**

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| Micro Data Base Systems Knowledgeman | $330 |
| MicroPro InfoStar | $245 |
| GMS Systems Power Base | call |
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WORD PROCESSING: **MS-DOS**

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| IUS EasyWriter II (with EasySpeller and EasyMailer) | $210 |
| MicroPro Wordstar professional pack | $370 |
| Wordstar 3.3 | $240 |
| Microsoft Word w/Mouse | $305 |
| w/out Mouse | $255 |
| Softword Multimate | $295 |
| SSI Wordperfect | $325 |
| VisiCorp VisiWord w/VisiSpell | $259 |

COMMUNICATIONS: **MS-DOS**

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| Hayes Smartcom II | $70 |
| MicroStuf Crosstalk XVI | $109 |

BUSINESS PACKAGES: **MS-DOS**

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| IUS | call |
| Informs | call |
| Dow Jones | call |
| XQ | call |

PROGRAMMING: **MS-DOS**

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| FORTRAN | $410 |
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| Pascal | $300 |
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ATI (various)

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64 K ram chip kit

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| Pegasus Hard Disk. The best buy in an easy-to-install, reliable hard disk – 10 MB to 40 MB | call call |
| Quadram Hard Disk | |
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| 300 G | $135 |
| 300 A | $145 |
| Quadram Quadchrome | $490 |
| Zenith Z122 amber monitor | $138 |
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### Megabucks From Your Microcomputer

A book, written by Tim Knight, offering advice on buying the right computer to begin with, and how to get the best possible return on that investment. The book provides information on how to write and market software, magazine articles, product reviews, and how to do other kinds of freelancing. Also included are ideas on how to use the computer to enhance creativity make investments, and avoiding pitfalls associated with freelancing.

*(List Price: $3.95)*
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*Indianapolis, IN 46268*
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## SERVICES

### Personal Computer Coverage

An insurance plan offering protection for personal computers and peripheral equipment, including printers, CRTs, preprogrammed or copyrighted software, and modems. The protection is offered on an "all risk" replacement cost basis, meaning a loss is paid on the basis of what it costs to replace the equipment and software at today's prices. In addition, there is automatic coverage of up to $1,000 for data stored that is lost or destroyed due to a covered loss.

The coverage protects a broader range of losses than would normally be covered in a homeowners policy, including losses stemming from blackouts, power surges, and accidental breakage.

Policies protect computers used for both personal and business purposes. Coverage is available in most states as an option on the insurers' homeowners, renters, or condominium policies.

*(List Price: $5 per $1,000 coverage)*
*Sentry Insurance*
*1800 North Point Dr.*
*Stevens Point, WI*
*(715) 346-6617*

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### PC Software Support Center

A subscription service offering technical assistance on 15 selected IBM-PC software products. A subscription includes seven single-topic phone calls to the Center's toll-free number for direct technical assistance, as well as a monthly software newsletter with tips and techniques, information on new products, and in-depth articles.

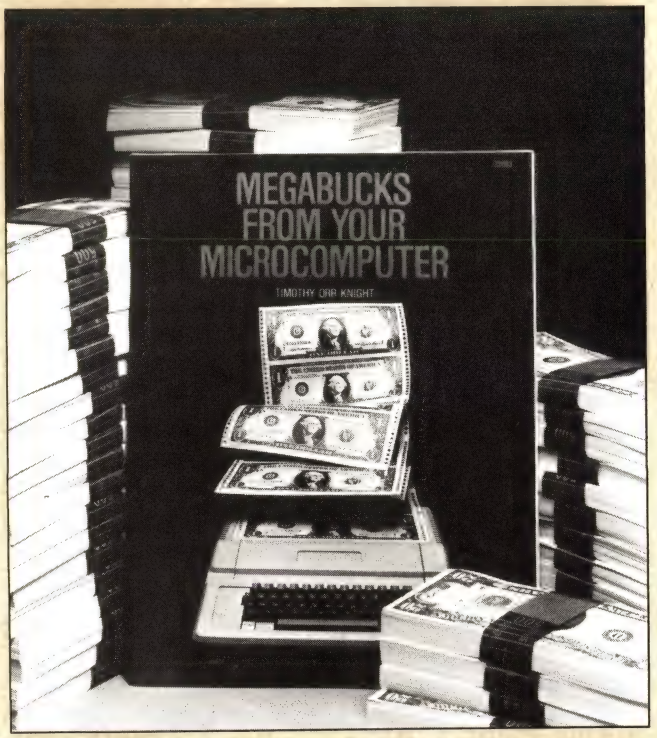
The Software Support Center can provide information on the following computer languages: APL, BASIC, BASIC Compiler, COBOL Compiler, LOGO, FORTRAN Compiler, MACRO Assembler, and Pascal Compiler. Also, information can be obtained on the following applications: asynchronous communications, BASIC programming development system, *Personal Editor*, *Professional Editor*, *Private Tutor*, *Word Proof*, and PC-DOS.

Subscribers can combine multiple calls to extend the time with an IBM representative or to cover different topics, and may purchase a package of seven additional calls for $350.

The service, a pilot program, is offered within a limited geographical area.

*(List Price: $380)*
*IBM Personal Computer Software Support Center*
*Boca Raton, FL 33432*
*(800) IBM-2700*

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***Megabucks From Your Microcomputer,*** *Howard W. Sams & Co., Inc.*

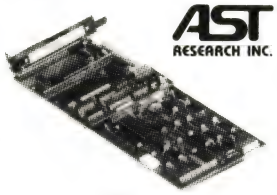
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AST RESEARCH INC.



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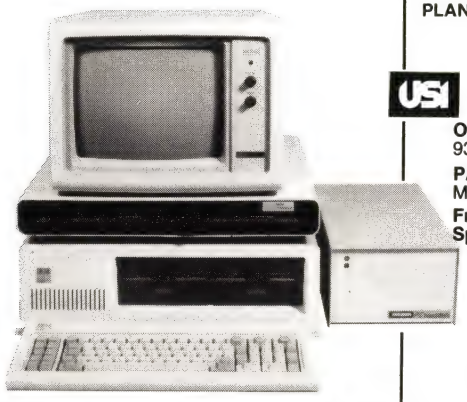
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- **EPSON** — FX-80 (160cps) .... **CALL**; FX-100 (160cps) .. **CALL**
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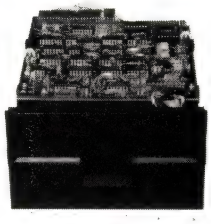
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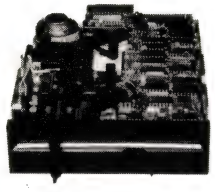
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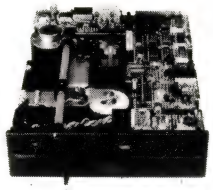
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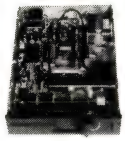
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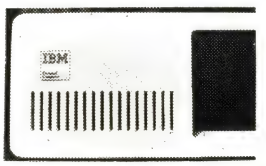
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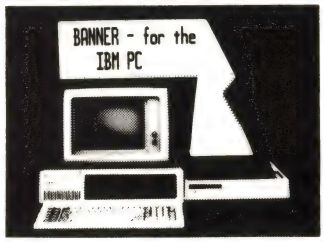
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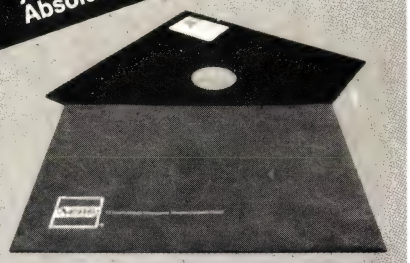
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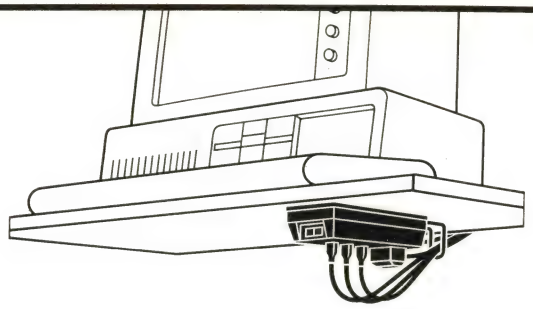
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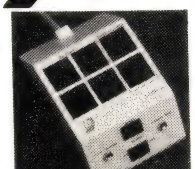
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# PC User Groups

This list is a partial directory of PC user group names and addresses. Use this listing to locate other PC aficionados who congregate in your area or around the world.

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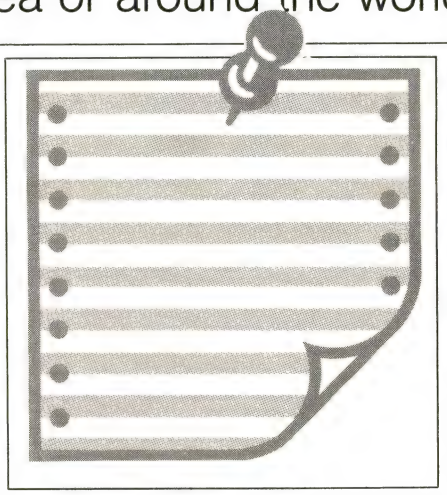
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(205) 879-3716

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3505 McGehee Rd.
Montgomery, AL 36111
(205) 281-6100

**The Greater Gulf Coast Users Group**
c/o Jim McGinnis
124 Meadow Wood Loop
Daphne, AL 36526
(205) 626-9558

## ALASKA

**The IBM PC and PC Compatible Computer Users Group**
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**Anchorage, AK 99503**



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**Phoenix IBM-PC Users Group**
P.O. Box 44218
Phoenix, AZ 85064
(602) 954-7519

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**Stanford/Palo Alto User Group**
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**701 Welch Rd., #310**
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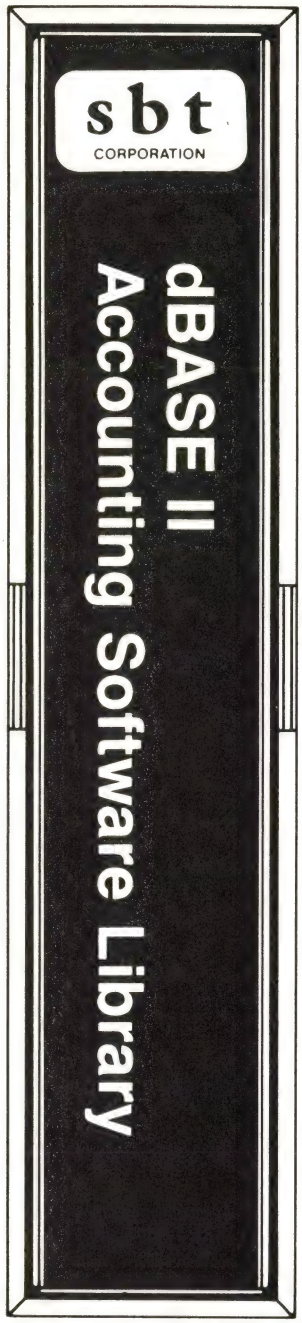
**San Diego Computer Society**
c/o John Field
1384 Caliente Loop
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(619) 421-9686

**IBM PC User Group**
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7255 Orchard Dr.
Gilroy, CA 95020

**Modesto-Turlock IBM PC User Group**
P.O. Box 5122
Modesto, CA 95352

**IBM Users Group of California**
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**Citrus Heights, CA 95610**

**Diablo Valley PC**
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Walnut Creek, CA 94596
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**Pasadena, CA 91101**
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**Peninsular IBM PC Users Group**
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San Francisco, CA 94101

**Fresno IBM-PC Users Club**
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Fresno, CA 93755

**Redding Area PC Society**
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Redding, CA 96001
(916) 243-4411

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**PC Users' Group of Colorado**
c/o Howard Weissman
P.O. Box 944
Boulder, CO 80306
(303) 443-5528 (evenings)

**Colorado Springs IBM-PC User Group**
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## DELAWARE

**PC Professional Users Group**
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Wilmington, DE 19899

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**Financial Institutions Users Group of the D.C. Metropolitan Area**
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First American Bank, N.A.
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Washington, D.C. 20005

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**Space Coast PC User Group**
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**Northern Florida Amateur Computer Club**
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Jacksonville, FL 32216

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North Miami, FL 33181
(305) 940-7566

## GEORGIA

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Macon, GA 31208
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**Athens IBM-PC User Group**
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(404) 543-0139 (night)
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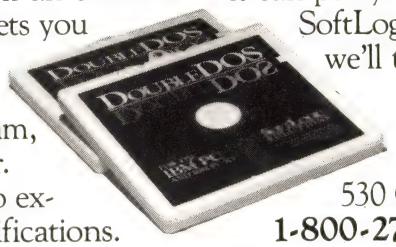
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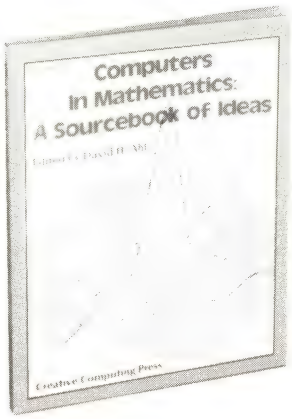
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ComputerLand
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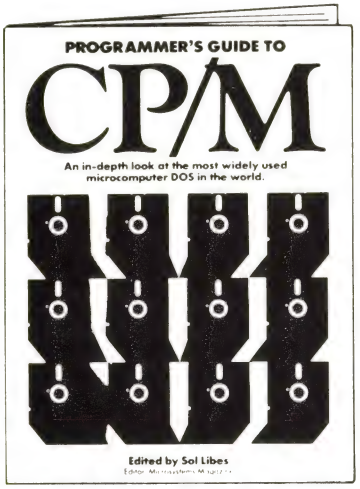
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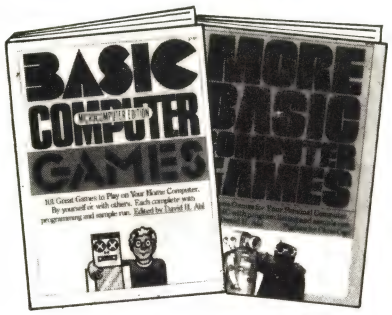
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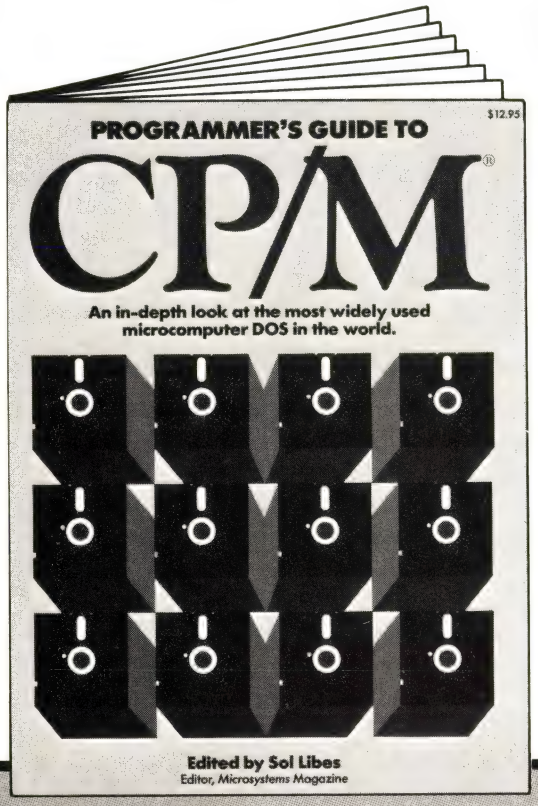
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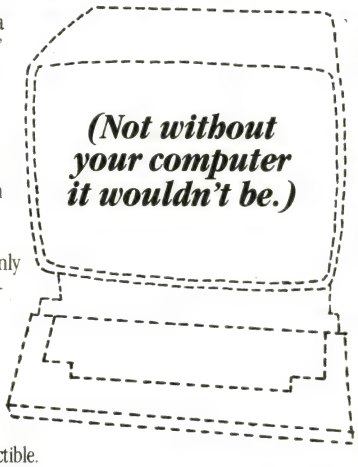
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# A Command Performance

## EBL is a powerful command list facility that promises to end much of the tedium of routine program testing. Best of all, it's almost free.



Illustration: Michael Ng

If you walk into any data processing department in America, you'll see rows of programmers sitting idly at terminals waiting for their compiles, links, and test runs to finish. Is this any way to earn a living? Seventy-five percent of programming consists of nursing mundane jobs through the system in order to discover the next round of bugs. Spending hours of your time hitting the Enter key just because the computer goes beep can lead to premature burn-out. In fact, many of these tedious steps could as easily be performed by a robot—or a computer program. Programming has evolved just such a solution.

In the early 1970s, about the time that Conversational Remote Job Entry (CRJE, pronounced *kridgie*) was liberating programmers from airless keypunch rooms, some of the larger minds at IBM began looking at the problem of terminal fatigue. If jobs submitted on cards could call up a number of programs in sequence using OS Job Control Language, why couldn't a programmer sitting at a terminal invoke a whole series of commands with a single supercommand? So they invented a new kind of file called a *command list* or CLIST, which turned out to be nothing more than a list of commands, one per line. If the file was named LIST1, then LIST1 became a new supercommand whose function was simply to issue the commands it contained.

CLISTs have now begun to take on more functions. The addition of parameter passing, conditional command execution, branching, subroutines, and external command list invocation have made CLISTs now look more like programs than data files—and, as a matter of fact, that's exactly what they are. The CLIST Language, Job Control Language, and VM/CMS EXEC Language, are all examples of interpreted command languages that partially automate the role performed by the programmer.

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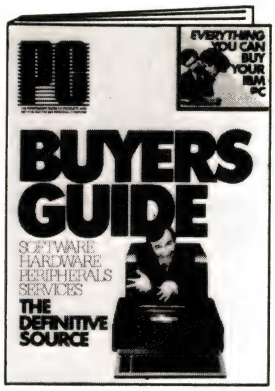
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with DOS, but for most of us this throwback to CRJE was nothing to get worked up about. DOS 2.0 enticed us with such functions as branching (GOTO), conditional execution (IF), and an offensively illogical kind of variable manipulation called SHIFT, but for old-timers, DOS 2.0 teases but doesn't deliver. Finally someone has solved the problem, and it's neither IBM nor Microsoft. A new "freeware" package called *Extended Batch Language (EBL)*, written by Frank Canova and distributed by Seaware Corporation, implements a command list facility so powerful that you can create multilevel menu drivers with it and even write simple games. Best of all, it can actually read the screen and "type" on the keyboard (i.e., place data in the keyboard stack). Aside from eating Szechuan food, real programmers could hardly do more.

*EBL* (version 2.0) statements are imbedded in standard DOS batch files and look suspiciously like CMS EXEC statements. Figure 1 is an example of a batch file written in *EBL*.

The word *bat*, with which most *EBL* statements begin, is the hook into the system since BAT.COM is the file in which all the code is kept. Once the first BAT command takes off, it initializes its resident portion and then reads and executes the rest of the *EBL* statements and DOS commands in the file. Subsequent *EBL* statements must also begin with the word *bat* to distinguish them from DOS commands, but because they don't need to reread the BAT.COM file, *EBL* is relatively fast. Let's look at each line.

The first line in Figure 1 is just a comment to the effect that this .BAT file will look for a CHESS.BAT file and, if found, will offer to play chess. If accepted, it will then pass control to CHESS.BAT. You might include logic like this as part of your AUTOEXEC processing to simplify booting. Just insert the chess diskette in the B drive, fire up the machine, and the computer will seem to anticipate what you have in mind.

Line 2 checks for the existence of the CHESS.BAT file on any drive (but only the current path if you're using DOS.2.x) and sets the variable %r to reflect the result as follows:

0 File found on default drive
1 File not found
9 Illegal filespec

Cleverly enough, if %r is none of these, then it will be set to the drive letter (a through d) the file was found on. The STATEOF command supports filespec wildcards, too. If the file is not found, line 3 instructs the program to leave the .BAT file. Other relational operators include >, <, and < >.

If the file is found, but not on the default drive, line 4 instructs the program to save the letter of the drive it *was* found on (concatenated with a colon) in the variable %d. Also, since variable names can only be one character in length, string concatenation is a simple matter of pressing the strings together.

Line 5 prints a message on the screen. The hexadecimal numbers following the backslashes provide screen attribute information—in this case, highlighting the word CHESS—while the semicolon suppresses a line feed so the cursor will stay near the question mark.

Mainframes don't provide character-by-character interaction with terminals, so users of time-shared CLISTs and CMS EXECs must hit the Enter key to register their responses. *EBL*'s INKEY function is patterned after Microsoft BASIC, which takes advantage of the fact that you have the whole computer to yourself. The next key pressed on the keyboard will be assigned to the %k variable. (The program can sense special keys by comparing them to special literals with a format of KEY*xxx*, where *xxx* might be 01b for the Esc key, for example, or 147 for the Home

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key.) Note the use of the command concatenation symbol "|" to group related commands (line 6 in Figure 1). This is useful in IF processing since all concatenated commands are executed on the same condition. The TYPE command reflects the user's response back to the screen.

## The Keyboard Stack

The final statement in Figure 1 checks the user's response. If y is pressed, three lines will be placed in the "keyboard stack." The keyboard stack refers to an area in storage where responses to upcoming reads to the terminal are stored *before they are requested*. If %d is to set to b:, for example, the three lines stacked when %k = y will be:

```
b:chess
n
24
```

These three lines are available to any program that reads from the terminal, including DOS itself when it's looking for the next command. Thus, when the current batch file is finished and DOS wants more work, it will find "b:chess" when it issues a read to the terminal and will proceed to execute the B:CHESS batch file. The next two stacked lines are hypothetical responses to questions from the chess program. The ability to use *EBL* to answer questions you know a program is going to ask makes program initialization and parameter setting much less tedious. You can also erase the stack with a STACK.PURGE command or merely defer it with a STACK.OFF command followed later by a STACK.ON.

*EBL* surpasses anything mainframers have in its ability to "read the screen." The READSCRN function reads the words from the previous line into variables that you name. Each successive READSCRN reads up the screen and also sets %r to the number of the line you've just read so you don't accidentally go beyond line 1. Thus you could read messages from a compiler, for example, and go on to the LINK command only if the last message was 0 ERRORS FOUND!

```
bat * Offer to play CHESS with the human...
bat stateof chess.bat
bat if %r = 1 exit
bat if %r <> 0 %d = %r:
bat type How about a nice game of \0fCHESS?\07 ;
bat inkey %k | type %k
bat if %k = y stack %dchess | stack n | stack 24
```

**Figure 1:** *An example of a batch file written in* EBL.

Other functions of *EBL* include:

| | |
|---|---|
| BEEP | Sound the alarm |
| CALL | Call a section of the batch file, which subsequently initiates a RETURN. |
| CLS | Clear the screen. |
| GOTO | Unconditional branch. Labels begin with hyphens and can be 15 characters long, such as -LINK.THE.PROG. |
| READ | Read an entire line from the keyboard (which benefits from the availability of all the editing keys) and set zero or more variables. Optionally, use TYPE to type a message first (you can do this with INKEY too). |

Variables are divided into DOS variables (%0 thru %9, which can be set as well as read) and "global user variables" (%a thru %o). Any variable can be up to 15 characters long. User variables are called global because they retain their values after the batch file has exited and can therefore be examined by any subsequent batch file that refers to them by name.

Besides the %r system variable (which can be set by any program by modifying the byte at 0:4FE), you also get:

| | |
|---|---|
| %q | "S" if there are lines in the stack; otherwise "K" (for keyboard). |
| %v | The current default drive (a single letter). |
| %s | A single space, used to embed blanks in variables. |
| %% | A single percent sign. |

## Special Assignments

Assignment statements come in several flavors, too. Aside from the garden variety illustrated above, you can perform nullification ("%a = "), and simple arithmetic using the standard +, −, / and * operators (as in "%a = %b + %c"). As if that weren't enough, you can also do length detection ("%a = %b #" means "Assign to %a the length of %b") and substring extraction ("%a = %b $ 1 3" means "Assign to %a the first three characters of %b"). These last formats become essential for advanced applications.

For a small charge, Seaware lets software developers include *EBL* batch files with their packages. So besides delighting legions of burnt-out programmers, it should alleviate the suffering of new users who, when they open a new $900 copy of brand-X software, are faced with 3 days of one-time setup procedures.

*Extended Batch Language* should be in the libraries of most computer clubs and dial-up services soon, but if you can't find it, send $30.00 to Seaware Corporation for a diskette containing the latest program version, on-line demo and a tutorial batch files, useful utilities, and a 70-page manual with descriptions, examples, and tips. There is also a bulletin board service where you can share the merry musings of a large community of *EBL* users. ■

---

*Dean Hannotte is a microcomputer consultant, an amateur violinist, and a bibliophile with a special interest in children's books on dinosaurs.*

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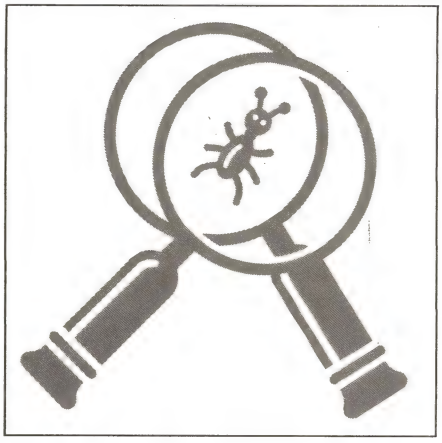
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EDITED BY PAUL SOMERSON

# User-to-User

PC readers use this forum to help one another by passing along their questions, solutions, comments, and complaints.



## BASIC Errors

An undocumented feature of the direct mode of MS-BASIC saves looking up the meaning of the 73 error codes (76 in version 2.0) in the BASIC manual.

When using the BASIC editor, entering the command ERROR, followed by the error code of interest, prints the corresponding error message, for example:

```
ERROR 26
FOR Without NEXT
```

BASIC 2.0 adds three additional error codes. Since the 2.0 instruction manual upgrade must be ordered by mail from IBM, this method can be used to investigate the new codes until the manual arrives. Codes 74, 75, and 76 are related to the structured disk directory functions that IBM added starting with PC-DOS 2.0, and the path names required to completely designate a file.

They are:

```
ERROR 74    Rename Across Disk
ERROR 75    Path/File Access
            Error
ERROR 76    Path Not Found
```

Dick Gall
Richardson, Texas

*Keep those undocumented discoveries comin' in.*

## Updates Made Easy

PC users often use the COPY A: *.* B: command to copy all files on drive A to drive B. Unfortunately, DOS lacks a command that would copy only files on drive A that *already exist* on drive B. The batch file UPDATE.BAT in Figure 1 will do it.

Note that the UPDATE.BAT file assumes that the backup disk is in drive B and the working disk is in drive A. I also use this method for backing up parts of a fixed disk's directory.

Mark Templer
Tempe, Arizona

*You can create a version of this file that will let you choose which disks to copy from and to (see Figure 2). Type everything except the A> prompt and the instructions inside the brackets.*

*If you want to copy all the files already on drive A from drive C to drive A, you would get into DOS and type:*

```
UPDATE C A
```

*then hit the Enter key. Note that you omit the colons after the drive names; the batch file puts them in for you. Be careful to type all the colons, percent signs (%), and double percent signs exactly as indicated, or you'll end up with a fine mess.*

```
REM    This program copies files selectively from
REM    drive A: to drive B:.  Only files already
REM    stored on drive B: will be copied from A:
REM    to B:.  If you want to interrupt this program
REM    type Ctrl-Break
PAUSE
B:
FOR %%F IN (*.*) DO COPY A:%%F B:%%F
A:
```

**Figure 1:** *Batch file to copy files that exist on two disks.*

```
A>COPY CON:UPDATE1.BAT                          [then hit the ENTER key]
%2:                                             [then hit the ENTER key]
FOR %%F IN (*.*) DO COPY %1:%%F %2:%%F          [then hit the ENTER key]
%1:                                             [then hit the ENTER key,
                                                 then hit the F6 key,
                                                 then hit the ENTER key]
```

**Figure 2:** *Improved batch file to copy files that exist on two disks.*

## Hard Disk Disaster

Owners of the IBM-PC/XT can suffer from a severe case known as the HDDDD, "Hard Disk Data Destroyed Disaster", if they are not careful when using the FORMAT command. If you boot from the hard disk (which then makes the C drive the default) and type FORMAT in preparation to format a floppy disk, DOS will assume you want to format the hard disk instead, and will reformat it (thereby erasing all your files) without any feelings of guilt.

The change in the FORMAT command in Figures 3 and 4 will force users to include a disk drive designation when using the command.

Another note of interest—IBM has just instructed all its dealers to distribute (for free) the DOS 2.1 version of FORMAT.COM. It has been rewritten to close up some "potential" problems.

Wesley Merchant
Vice-President
Capital-PC Club
Annandale, Virginia

*It's about time. Many thanks from all us hard-disk users.*

## Format Snooping

It is often useful to be able to determine in what format a BASIC program was saved. This can be done by checking the first byte of the file. For protected files (saved with the "P" option), the first byte is ASCII 254. Standard tokenized files are marked with ASCII 255 in the first byte. ASCII files are not marked at all. We can treat any file as a sequential file, read in its first

```
C>DEBUG FORMAT.COM
-A 17B
xxxx:017B  JMP 160
xxxx:017D  NOP
xxxx:017E  NOP
xxxx:017F  NOP
-W
Writing 1780 bytes
-Q
```

**Figure 3:** *DOS 2.0 instructions for fixing FORMAT.COM. Type everything underlined and Ctrl-Break before the W.*

```
C>DEBUG FORMAT.COM
-A 191
xxxx:0191  JMP 16B
xxxx:0193  NOP
xxxx:0194  NOP
xxxx:0195  NOP
-W
Writing 1B00 bytes
-Q
```

**Figure 4:** *DOS 2.1 instructions for fixing FORMAT.COM. See Figure 3.*


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record, and test the first byte. The program in Figure 5 will do this job.

You can use DEBUG to see the marker in the flesh. Write a simple BASIC program line such as: 10 ABCDE. Now save it three times, first as A.BAS, A in ASCII format, second as P.BAS, P in protected format, then as T.BAS with a plain save command. Go to DOS and type in DEBUG A.BAS, then D 100, and you will see the following: 31 30 20 41 42 43 44 45, and some junk that doesn't interest us. This is the ASCII translation of the program, character by character, in hexadecimal notation. Type Q to quit DEBUG and then type in DEBUG T.BAS, and then D 100. The first byte is FF (decimal 255). The following two bytes hold the address where the next program line could begin, and the program follows: 0A is the line number, 00 is the space, and the program itself is 41 42 43 44 45. Quitting again and doing the same routine for P.BAS will show data that makes no sense, except that the first byte is FE as promised.

Harold Brown
DeKalb, Illinois

*While it's faster and easier to use DEBUG for this, the program is instructive.*

## Printer Test Redux

There seems to be a problem with the Printer Test in the Volume 3 Number 3 "User-to-User." If you check the IBM *Technical Reference* manual (August 1981 printing) you will note that on page 2-68 the address given for the "IBM Monochrome Display & Printer Adapter" is 3BDh, which corresponds to 957 decimal, as used in the test.

However, on the same line of the chart, the address for the "Parallel Printer Adapter" is given as 379h, which corresponds to decimal 889. INP(889) gives the appropriate results on our machine, while INP(957) does not.

Incidentally, if you glance at page 2-67, you will find corresponding addresses

```
100 ' BASIC program format checker -- by Harold Brown (adapted by PC)
110 '
120 ON ERROR GOTO 430
130 INPUT "Enter the name of the file you want checked: ",FLNM$
140 '
150 '   -- capitalize filename and check for extension --
160 '
170 FOR A=1 TO LEN(FLNM$)
180 IF MID$(FLNM$,A,1)=CHR$(46) THEN FLAG=-1
190 IF ASC(MID$(FLNM$,A,1))<97 OR ASC(MID$(FLNM$,A,1))>122 THEN 210
200 MID$(FLNM$,A,1)=CHR$(ASC(MID$(FLNM$,A,1)) AND 95)
210 NEXT
220 '
230 '   -- check for extension and add .BAS if necessary --
240 '
250 IF FLAG THEN 300
260 IF RIGHT$(FLNM$,4)<>".BAS" THEN EXT$=".BAS"
270 '
280 '   -- open file and examine first byte --
290 '
300 OPEN FLNM$+EXT$ FOR INPUT AS #1
310 LINE INPUT #1,L$
320 A=ASC(L$)
330 PRINT "The file ";CHR$(34);FLNM$;EXT$;CHR$(34);" is saved in ";
340 IF A=254 THEN 370
350 IF A=255 THEN 380
360 PRINT "ASCII format.":GOTO 390
370 PRINT "protected format.":GOTO 390
380 PRINT "tokenized format."
390 CLOSE #1:END
400 '
410 '   -- file not found --
420 '
430 IF ERR=53 THEN PRINT "Sorry, that file is not on your disk"
440 RESUME 130
```

**Figure 5:** *Program to examine format of BASIC files.*

```
10 FOR I=0 to 1024:IF INP(I)= 223 THEN PRINT I;
20 NEXT
```

**Figure 6:** *A short test program for your printer.*

```
100 '  Dynamic Printer Status Line Display -- by John P. Bedell
110 '
120 DIM BIT(8)
130 FOR I=0 TO 7:BIT(I+1)=2^(7-I):NEXT I
140 CLS
150 PRINT "PRINTER STATUS FROM PORT 957 =      (DECIMAL)"
160 PRINT
170 PRINT "BUSY---------->"
180 PRINT "ACKNOWLEDGE--->"
190 PRINT "OUT OF PAPER-->"
200 PRINT "SELECTED------>"
210 PRINT "OUTPUT ERROR-->"
220 PRINT "NOT USED------>"
230 PRINT "NOT USED------>"
240 PRINT "TIME OUT------>"
250 RAWSTATUS = INP(957)
260 '
270 '  -- INVERT LINES : -BUSY, -ACKNOWLEDGE, AND - ERROR.
280 '
290 STATUS = RAWSTATUS XOR 200
300 '
310 '  -- EXAMINE EACH BIT AND PRINT HIGH/LOW ACCORDINGLY
320 '
330 FOR I = 1 TO 8
340 LOCATE 2+I,17
350 IF (STATUS AND BIT(I)) <> 0 THEN PRINT "HIGH" ELSE PRINT "LOW "
360 NEXT I
370 LOCATE 1,31:PRINT RAWSTATUS
380 '
390 '  -- WAIT FOR A CHANGE IN THE RAWSTATUS
400 '
410 IF RAWSTATUS = INP(957) GOTO 410
420 GOTO 250
430 RUN
```

**Figure 7:** *A program to display printer status dynamically.*

of 3BEh and 37Ah, respectively. 37Ah is decimal 893. INP(893) also returns 223 only when the printer is on line and ready to go on my PC.

It is possible that serial printers might give different results. Readers could check what worked on their installation by running the short test program in Figure 6 with the printer on-line, ready to go.

Now turn the printer off-line and check INP (of the numbers you got in response to your program).

It may well turn out that all installations could be covered by some OR combination of the codes.

Ada Booth
Santa Clara, California

*You're right. The problem is that we tested it on the printers in the office and it worked; but we obviously didn't try a large enough variety of machines. Thanks also to Joan Young, and Russel C. Moe, who spotted this problem. For an interesting look at how this works, see the letter below from John Bedell.*

## Dynamic Printer Test

The program in Figure 7 dynamically displays the printer's status bits as either high or low. You can then check the lines in the cable by placing the printer on/off line and removing/adding paper. If a particular status line does not change, look up the pin number in the reference manual and examine both ends for a broken wire.

John P. Bedell
Royal Oak, Michigan

*This display technique is very clear—can anyone out there adapt it to any other status checks?* ■


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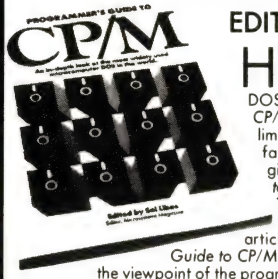
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# PC Tutor

## Multiplication Problems

**Q:** I work for a company that makes printed circuit boards. A few months ago we bought an IBM XT, which was just what



we needed. Since then, I have written the software for the company's computer. Now we find that we need a multiuser system. We want to add several more terminals (two to seven) that would access the XT.

Although I've heard that such systems are available for the IBM PC, I have yet to locate any that suit our needs. Also, since my knowledge of hardware is limited, a solution that would require me to wire up some fancy interfaces probably wouldn't work. Can you recommend any systems that might be of use to us? We don't need anything fancy.

Gregory Fedor
Bedford Heights, Ohio

**A:** *I'd need substantially more information to come up with a solution for your specific situation. What I can do here is suggest a few approaches that might work for you or help other users.*

*The setup you want might require a multitasking or multiuser operating environment, so I'll explain what these two things are.*

*A multitasking operating system lets more than one program run at the same time. It might also allow the simultaneous programs to access a common set of files. In most multitasking systems, only one program at a time can write to a specific file. (Although PC-DOS 2.0 is not a multitasking operating system, version 3.0 probably will be.)*

*Digital Research's Concurrent CP/M-86 is one multitasking operating system that's now available. It can handle up to four programs running simultaneously, which could include a spreadsheet, word processor, and database manager. Since you could combine various commercial programs with those you create, the Concurrent CP/M-86 approach might be useful to your company.*

*A multiuser operating system will let more than one person at a time run programs on the same computer. By nature, a multiuser system is a multitasking one, too, since the simultaneous users would be running different programs or doing different things with the same program. Most mainframe computers today are multiuser systems.*

*AT&T's UNIX is a multiuser operating system, and so is XENIX, Microsoft's version of UNIX. Another multiuser multitasking operating system for the IBM PC, based on UNIX System III, is VENIX from VentureCom, Inc. (215 First Street, Cambridge, MA 02142). Note that PC/IX, IBM's release of UNIX for the PC, is multitasking but not multiuser.*

*You say you don't need anything fancy. If your definition of "fancy" is "a system using anything but PC-DOS and BASIC," you may be closing off some of these viable options.*

*Since PC-DOS 2.0 isn't even multitasking for a single user, none of the multiterminal programs that run under PC-DOS are systems that can handle more*


**PROGRAMMER'S GUIDE TO CP/M**

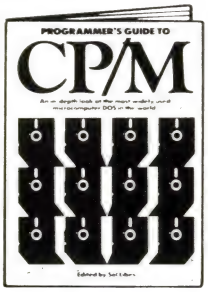
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*than one user accessing one file at a time. Also, if your program is written in IBM's BASIC, and uses any of the PC's special graphics and screen-handling functions, then any attempt to run these programs on a multi-user system is doomed to defeat.*

*If your BASIC programs do not use these special features, you might be able to make them run after switching to one of the operating systems that can handle simultaneous users. The solution is easier if your programs are written in the C language.*

*If your own applications programs are simple enough, you might be able to adapt them to support additional terminals. Routines to do this could poll each terminal's serial port (i.e., read them one at a time). When the polling process finds activity at a port, the program can process the characters entered at that terminal. If there's no activity, the program goes on to check the next terminal's port. This method could be feasible, provided your program won't be asked to work too hard for too many users at once.*

The PC is ill-suited to a multiuser environment. Its processor is probably not fast enough to support simultaneous users.

*In any case, there are two problems with having a multiuser program running on a system with several terminals attached to a PC. First, the program can't take advantage of the PC's display capabilities because the terminals do not share the PC's display memory. Second, the keyboards on most terminals differ from the PC's, so programs that expect a user to press specific keys (such as the PC's function keys), will not work at the terminals.*

*I believe the present IBM PC is ill-suited to a multiuser environment. Unless all your applications involve a lot of "think time," so only one person at a time is actually using the processor, the PC's 8088 processor is probably not fast enough to support a number of simultaneous users. Running a system with seven users (the upper limit in your proposal) is completely out of the question. If your company needs a setup of that magnitude, you might be better off purchasing a faster computer that is equipped with a multiuser operating system.*

### Batch Files in the SHELL

**Q:** I can't seem to get BASICA to execute batch files. When I try using the command RUN "BATCHFIL" there's an error message indicating "File Not Found." I don't care if my BASIC program is erased when the batch file runs, because I plan to have the last command in the batch file invoke the BASIC program again.

Larry Steinbacher
LaSalle, Colorado

**A:** *With PC-DOS 2.0 you can execute a batch file—or run any other program—while running BASICA by making use of the SHELL command within your BASIC program. Here's a sample program that includes the SHELL command:*

```
10 SHELL "DIR A:"
20 CLS
30 PRINT "This is a test"
```

*The first line of this BASIC program will execute a DIR command from PC-DOS to print a directory of drive A. The second and third lines then use standard BASIC commands to clear the screen and display a line of text.*

*In line 10, if you replaced "DIR A:" with the name of your batch program (surrounded by quotation marks), that program will be run from within BASIC. Note that your batch file should not have a line*

# BULL????



A lot of it is being slung around! Clearly, you need a lot more than just an index finger and an elbow to meaningfully use a computer. Is having a cluttered screen of options and windows easier? After the first blush of novelty and gimmickry and puffery wears off, will it really be easier and better? One thing is for sure — *it is going to take time to shake these new systems out and make them functional in user environments.*

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*that will rerun BASICA. This would cause two copies of the language interpreter to be loaded into memory, causing a significant waste of RAM.*

*When your task is ready to return to BASIC, simply write lines in your BASIC program that will be executed following the SHELL command, such as lines 20 and 30 above.*

With PC-DOS 2.0 you can execute a batch file while running BASICA by making use of the SHELL command within your BASIC program.

*Oddly enough, the manual for BASIC 2.0 makes no mention of the SHELL command in either its index or its alphabetical list of commands. (See "Treasures Buried in BASIC" in* PC, *Volume 3 Number 5, page 60.) What the SHELL command does is to load the PC-DOS command interpreter program (COMMAND.COM) and have it execute the commands named in the argument (surrounded by quotes) that follows the word SHELL. The results are similar to those you'd get if you responded to a PC-DOS prompt (such as A>) by typing in the commands that follow SHELL.*

*If you use BASICA with PC-DOS 1.1, then there's no SHELL command for you to call on. In that case, unfortunately, there's no way to run a batch program from within BASIC. What you can do instead is to write the BASICA program calls as part of a longer batch program that's started from PC-DOS. That way you can break your BASIC program into portions, each of which concludes and returns you to PC-DOS at appropriate spots.*

*This batch program, for example:*

```
BASICA "PROG1"
DIR A:
BASICA "PROG2"
```

*will run the first portion of your BASIC program (named PROG1 here), then perform DIR A: (or any number of PC-DOS commands), and finally load and run the second part of your BASIC program (PROG2).*

*If you are clever enough to manage it, you can have your BASIC programs alter the batch file as they run. You must be sure, however, to avoid changing any text in the batch file that comes before the call to BASICA.*

### Switching to 80 Columns

**Q:** When I boot up my PC with PC-DOS 2.0, the screen starts out displaying 40 columns. I know I can change it to 80-column and color operation by keying in the MODE CO8O command.

Can I get the computer to start out with an 80-column color screen, no matter what disk I use to boot up? Surely I don't have to write an AUTOEXEC program to do that.

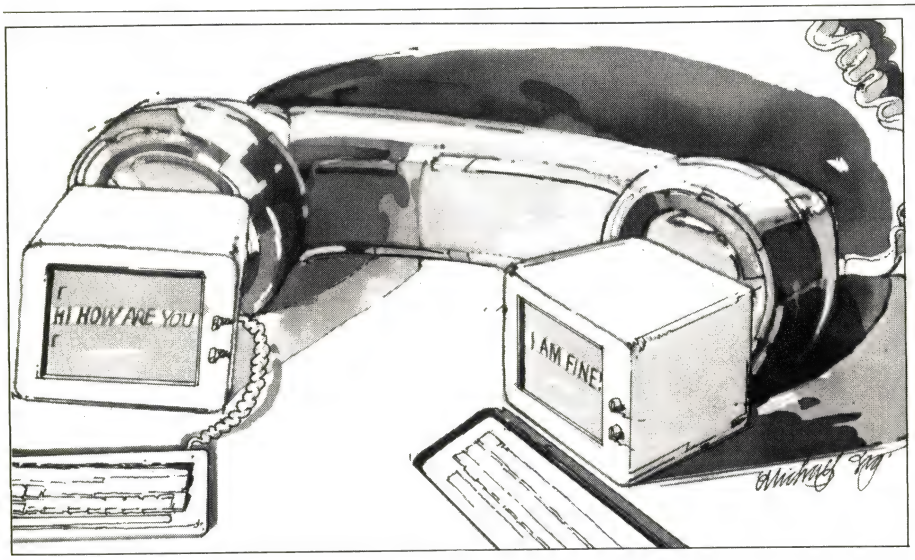
B. F. Cell
Edinburg, Texas

**A:** *Your problem is simply that some of the switches are set incorrectly on the system board of your PC. To change the display setting to 80 columns and to color, find Switch 1 and set its position 5 to on and its position 6 to off. For specific diagrams and more information, see pages 5-13 and 5-15 in IBM's* Guide to Operations. ■

The PC Tutor solves practical problems and explains points of general interest to users of the IBM Personal Computer. If you'd like to see your questions answered in this column, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

# Can We Talk? A Modem Primer

## Are you ready to venture into the swamp of communications jargon? If you think you are, read on and you will learn much more about modems than the average PC user knows.




A modem is a device that lets a computer talk over the phone lines. Unfortunately, that's about the extent of most PC users' knowledge of modems, with good reason. Beyond this simple level of understanding, it's easy to get lost in a swamp of communications jargon: duplex, echoplex, baud rates, protocols, direct connect versus acoustically coupled, and on and on.

If you're a bit confused about communications, but you're willing to venture into the swamp, read on. I'll tell you all about modems: what they are, what they do, and the differences between one species and another.

To begin with, modems have more to do with communications than with computers so it helps to know a little communications jargon, particularly the terms *baud rate, duplex,* and *echoplex.*

*Baud rate* is a measure of speed. The rule of thumb for converting baud rate into characters per second is to divide by 10—300 baud translates to 30 characters per second, and 1200 baud translates to 120 characters per second. Technical purists will quibble with this conversion, but it works. Nonetheless, remember that it is only a rule of thumb.

*Duplex* means two-way communications and is broken down into *half-duplex* and *full-duplex.* In half-duplex communications, each side of a conversation must wait until the other is finished, which is similar to the way a CB radio works. In full-duplex communications, either side can transmit at any time, which is similar to the way a telephone works.

Most modems contain either a mechanical or electronic switch that is labeled full-duplex/half-duplex. This switch is the cause of a great deal of confusion about modems, because it actually has nothing to do with the duplex setting. If your modem has such a switch, you are always engaged in a full-duplex conversation no matter how it's set. The problem is simply that the switch is mislabeled. It should be called echoplex/nonechoplex.

When you're communicating by computer, it is often helpful to have some way to double-check that the person at the other end receives correct information. Telephone lines can be noisy, and the noise can garble the information you're sending. One of the simplest methods for double-checking the information is echoplex, in which the receiving side echoes each letter you send. When you type a letter on your keyboard, it travels out your modem and over the phone lines, is received by the system on the other end, is echoed back to you, and finally shows up on your screen. If the letter on your screen is the same one you typed, you can be reasonably sure that it was received correctly at the other end.

Most systems take advantage of echo-

Illustration: Michael Ng

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plex, but if the system you're talking to is not using it, you'll want your own system to put a character on your screen. Otherwise you'll wait for an echo that will never come. Most modems give you a way to switch between distant echo (from the other system) and local echo (from your own modem), although they don't usually call it that. By some perversion of logic, the industry has managed to draw an equation here and has wound up calling local echo *half-duplex* and distant echo *full-duplex*. This is certainly confusing, but the mistake is nearly universal, and we're stuck with it.

### Standard Protocols

What really determines the duplex nature of your conversation is the protocol that your modem is using. Each protocol is a different scheme for sending and receiving information. In a sense, the difference between one protocol and another is like the difference between AM and FM radio. You don't have to know much about the protocols themselves, but you do have to make sure that the protocol on your end matches the protocol on the other. There are over a dozen different communications protocols for modems, but only two are of any real importance to most PC users.

The first and by far the most common protocol is Bell 103, a full-duplex protocol that functions reliably over standard phone lines at speeds up to about 600 baud. All but a few 103-compatible modems, however, have a maximum rate of 300 baud. Some 103-compatible modems are limited to 300 baud only, which is by far the most common speed used with this protocol. Other modems are limited to 110 and 300 baud, the two most common speeds, and still others can function at any of the standard speeds between 0 and 300 baud.

There is also a Bell 113 protocol, which is completely compatible with the 103 protocol. As a result, you will sometimes see references to the "103/113 protocol" or the "100 series protocol"; they mean the same thing.

A protocol that is rapidly gaining in popularity is the Bell 212A, which is also full-duplex. Unlike the 103, though, the 212A protocol is capable of reliable 1200-baud transmission over standard phone lines. 212-compatible modems are more expensive than 103-compatible ones, but they let you spend over 75 percent less time on the phone. The savings in phone bills alone can easily pay for the difference in the price.

> A direct connect modem is plugged directly into a part of the phone system.

Most large on-line systems, including CompuServe, Dow Jones News/Retrieval, NewsNet, and The Source, can communicate with either a 103-compatible or 212-compatible modem. Some small bulletin board systems can also communicate with either protocol; others are limited to 103-compatibility.

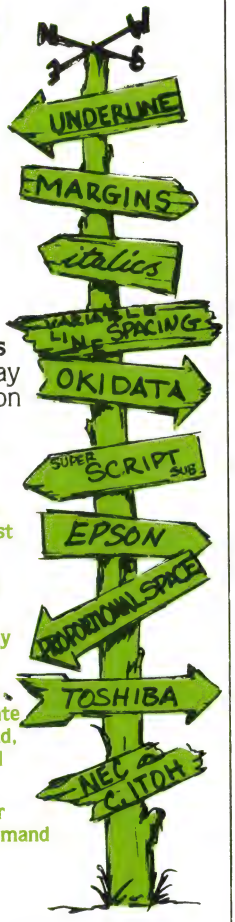
### Meet the Modems

This discussion brings us to the modems themselves. An individual modem may or may not have some options, but most fall into one of four groupings.

- **103-compatible, acoustically coupled, standalone modem.** If there is such a thing as the archetypal modem, this is it. *Standalone* means that the modem sits outside your PC and is connected to it through a cable to your RS-232 serial port. The RS-232 port is an industry-wide standard that lets two pieces of equipment talk to each other. You'll find the port on your PC's communications card.

  *Acoustically coupled* means that this type of modem uses the telephone the same way you do. It sends information by speaking into the phone handset and receives information by listening to the other end of the handset. Acoustic modems have two rubber cups (one for each end of the handset) to hold it in place and


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to help muffle any noise in the room. Any noise the modem picks up will usually be translated to garbage characters in transmission. To use an acoustically coupled modem you simply make a call to another computer and then put the handset in the rubber cups. Typical acoustic modems cost between $100 and $200.

• **103-compatible, direct-connect, standalone modem.** The basic difference between this kind of modem and the first is in the way it connects to the phone lines. A direct connect modem is plugged directly into a part of the phone system, usually the wall module. You can then plug in a phone along with it, using a Y connector. In some cases you can plug the phone directly into the modem instead.

Some direct-connect modems are capable of auto-dialing; you can dial either directly from your keyboard or through your software by storing the number in a phone directory. Direct connect modems can include a wide range of additional options besides auto-dialing. Depending on the options, these modems range in price from under $100 to about $300.

• **103/212-compatible, direct-connect, standalone modem.** The only difference between this category and the last is the additional ability to communicate at 1200 baud with 212 protocol. This capability carries with it an increase in price; 103/212-compatible direct-connect modems start at about $450.

• **103/212-compatible, direct-connect, modems-on-a-board.** Once again, this variety adds only one new wrinkle. The modem-on-a-board slips into a slot in your IBM PC so you don't need a communications card or a cable to connect the modem to the computer. These modems also tend to be cheaper than their standalone cousins; they start at about $500 but are equivalent in capabilities to standalone modems costing $600 or $700. In addition, they usually include software as a bonus.

This list doesn't include every modem, but it does cover the most common varieties. In future issues I'll look at some specific modems in each category. ■

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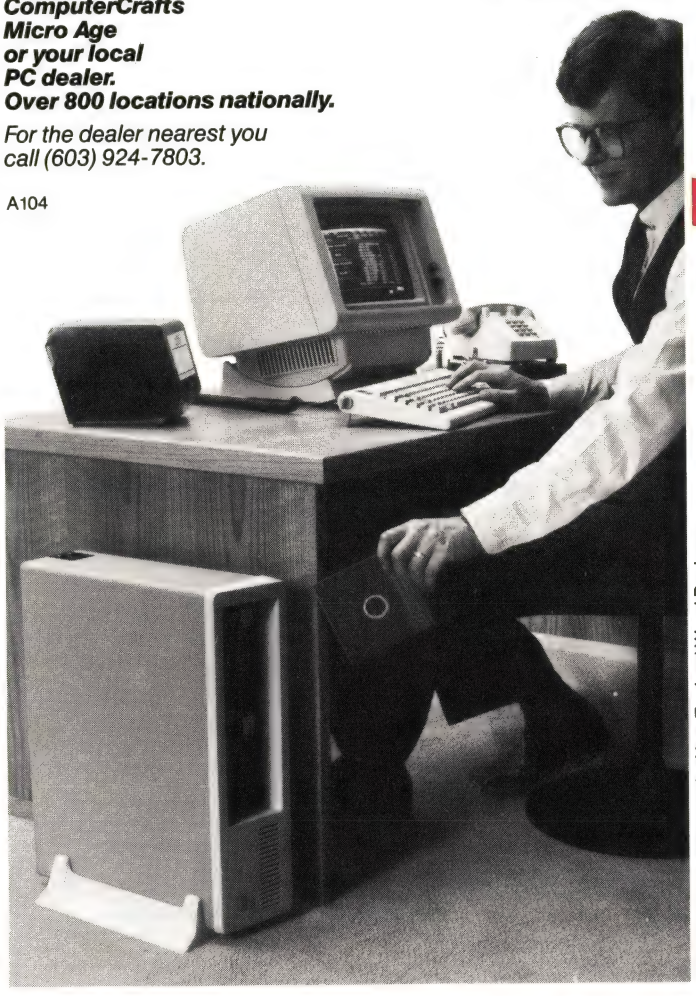
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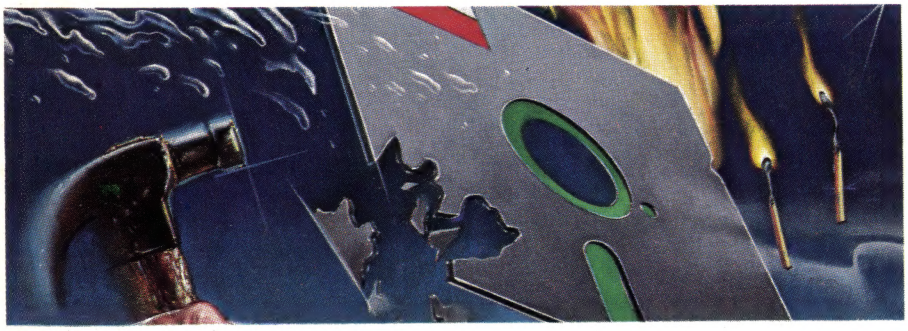
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CIRCLE 220 ON READER SERVICE CARD

The Independent Guide to IBM Personal Computers

# Coming Up



## The PC Portable

The IBM Portable PC has made its debut and is bound to have a profound effect on the portable computer market. We'll venture into that marketplace to explore who will buy the machine, why it was introduced now, and what went into its construction and marketing. We'll also test the PC portable's compatability with other IBM products and see how it stacks up against its predecessors.

## PCs in the White House

Forty PCs are scheduled to enter the White House as part of EOPNET, the new executive office of the president network. We'll take a look at this state-of-the-art system that is automating the office of the president.

## Simulating Flight

The intrepid Paul Somerson will attempt to use the Microsoft *Flight Simulator* as an actual flight instructor. Then, we'll take him up in a Cessna and see how much he's learned. Will Paul live to write about his experience? Stay tuned.

## The Toughest Floppy Disk in Town

How tough are floppy disks? Howard Karten will torture a set of floppies to find out. Will the disks stand up to moisture? Sound? Fingerprints? Coca Cola?

## Offbeat Accessories

Diskette stands, micro-perforation paper, and blank function-key templates are just some of the unusual yet useful accessories to be reviewed in this article. Some of these offbeat add-ons just might make using your PC more productive.

## Micros for Migrants

PCs are being used in a national campaign to aid in the education of thousands of children from migrant worker families. We'll look at how PCs are being used as an administrative and as an educational tool.


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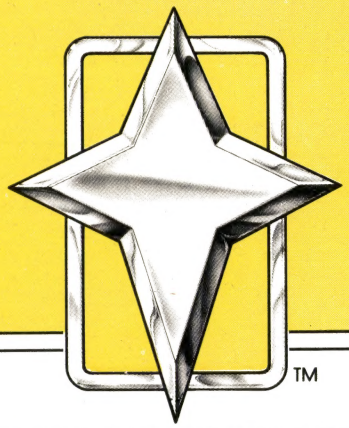
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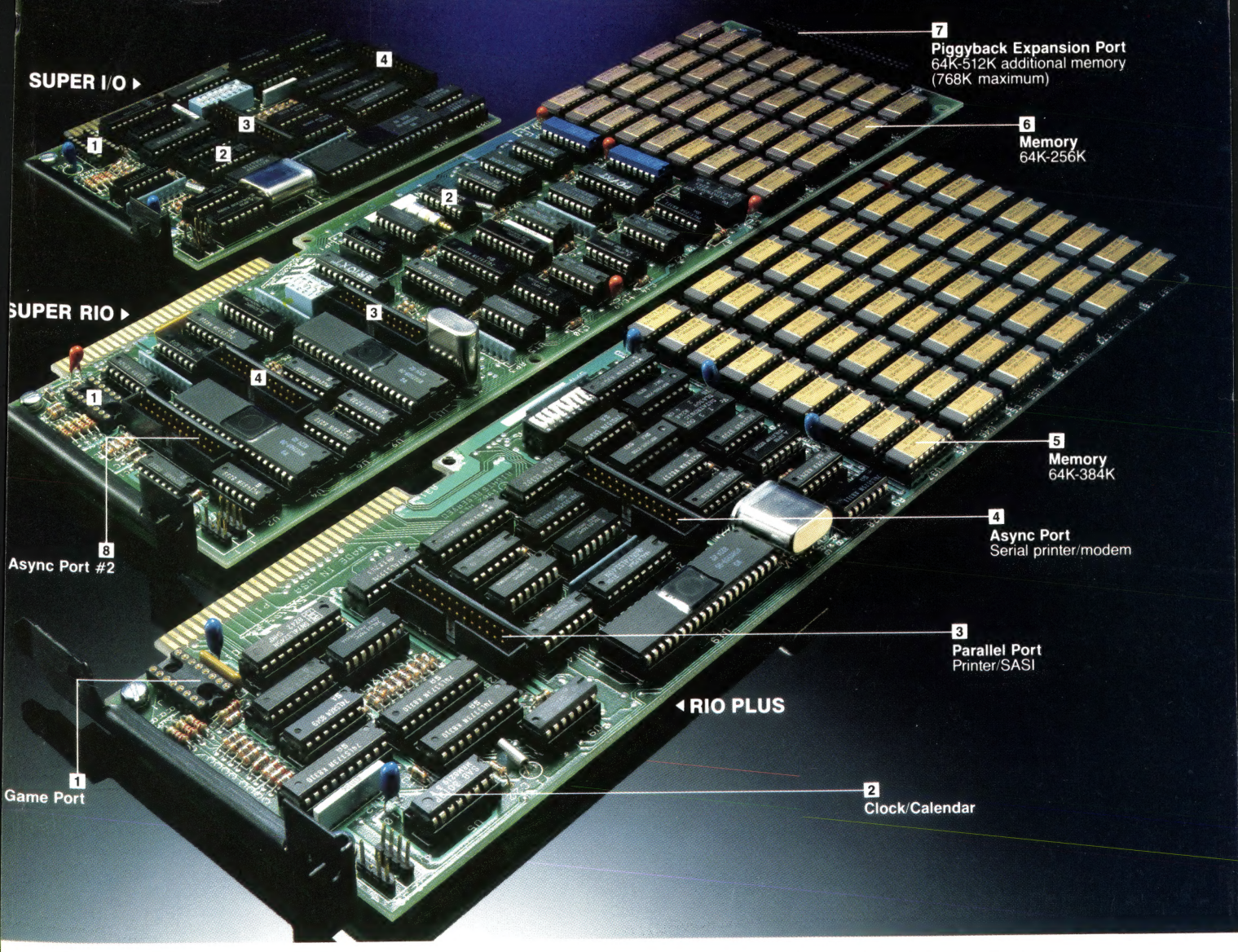
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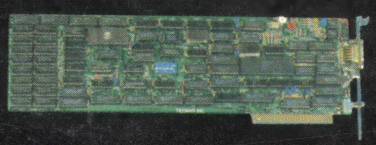

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